

به نام خدا



مرکز دانلود رایگان
مهندسی متالورژی و مواد

www.Iran-mavad.com



Subject Index

Page numbers suffixed by T and F refer to Tables and Figures respectively. vs. indicates a comparison.

A

- abrasion
 - abrasive blasting
 - buried and ground-contact structures 4:2705
 - marine vessels 4:2687*t*
 - surface pretreatments
 - general discussion 4:2492
 - surface finish 4:2492
 - surface profile 4:2492
 - tribocorrosion mechanisms
 - basic concepts 2:1031
 - open circuit potential (OCP) 2:1034*f*
 - sliding metallic surfaces 2:1032*f*
 - synergy levels 2:1038*f*
 - tungsten/tungsten carbide (W/W₂C) phases 2:1033*f*
 - wear rates 2:1032*f*
 - wear theory 2:1028, 2:1028*f*
 - accelerated low water corrosion (ALWC) 3:1729, 4:3200
 - acetal resins 3:2379*t*
 - acetate 3:2060*t*
 - acetic acid
 - acidic vapor corrosion 2:1326
 - aluminum coatings 4:2564*f*
 - anodic protection 4:2882
 - cast iron corrosion 3:1766, 3:1767*t*
 - copper/copper alloys 3:1963
 - corrosion predictions 4:3059*t*
 - dry deposition rates 2:1073*t*
 - Henry's law coefficients for common gases 2:1056*t*
 - inhibitors 4:2990
 - nickel/nickel alloys 1:98*f*
 - production processes 3:1907
 - solubility parameters 3:2380*t*
 - stainless steels 3:1842
 - wood 2:1324, 3:2444
 - zirconium corrosivity 3:2125
 - acetone 1:98*f*, 3:2380*t*
 - acetylacetone (C₅H₈) 2:1067*f*
 - acid corrosion
 - aluminum alloys 3:1998, 3:1999*f*
 - copper/copper alloys 3:1963
 - glasses 3:2313
 - inhibitors 4:2908
 - iron–nickel (Fe–Ni) alloys 3:1792, 3:1792*t*
 - maraging steels 3:1795
 - microbially-induced corrosion (MIC)
 - sulfate-reducing bacteria (SRB)
 - concrete degradation 2:1180
 - fungi 2:1181
 - sulfuric acid (H₂SO₄) 2:1179, 2:1180*f*, 2:1181*f*
 - mineral acids
 - glass enamel corrosion 3:2073, 3:2326
 - lead corrosivity 3:2063
 - niobium corrosion 3:2144, 3:2145*f*
 - tantalum corrosion 3:2144, 3:2145*f*
 - organic acids
 - aluminum alloys 3:1998–1999
 - anodic protection 4:2882
 - glass enamel corrosion 3:2073, 3:2326
 - lead corrosion 3:2063
 - molybdenum corrosion 3:2163
 - acidic cleaners 4:2485
 - acidic vapor corrosion 2:1326
 - Acidithiobacillus ferrooxidans* 4:2949
 - Acidithiobacillus thiooxidans* 4:2949
 - Acidovorax* spp. 2:1179
 - acid pickling
 - alloy steels 4:2489, 4:2992*t*
 - general discussion 4:2487
 - hydrogen embrittlement 2:907, 4:2489
 - millscale formation 4:2487
 - nonferrous metals 4:2491, 4:2491*t*
 - pickling inhibitors
 - basic concepts 4:2990
 - characteristics 4:2992*t*
 - hydrofluoric acid (HF) 4:2993*t*
 - inorganic inhibitors 4:2490
 - nitric acid (HNO₃) 4:2993*t*
 - organic inhibitors 4:2489, 4:2490*f*
 - phosphoric acid (H₃PO₄) 4:2993*t*
 - sulfuric acid (H₂SO₄) 4:2992*t*
 - scale removal mechanisms 4:2488, 4:2488*f*, 4:2991, 4:2993*t*
 - acid-producing bacteria (APBs) 4:2949, 4:3279
 - acid rain 2:1062, 2:1064*t*
 - acid-resistant bricks 3:2338, 3:2338*t*
 - acid soils 3:2087*t*, 4:2563*t*
 - acrylate esters 3:1909
 - acrylic acid 3:1909, 4:2966
 - acrylic elastomers (ACM)
 - applications 3:2412*t*
 - heat/oil resistance class 3:2413*f*
 - protective measures 3:2431
 - structure–property relationships 3:2416*t*
 - vulcanization systems 3:2436
 - acrylic polymers 4:2652, 4:2995*t*, 4:3328
 - acrylonitrile–styrene–butadiene polymers (ABS) 3:2382, 3:2385*t*, 4:2578
 - additives
 - lubricant systems
 - additive types 2:1302, 2:1303*t*
 - extreme pressure/antiwear additives 2:1302, 2:1303*t*
 - in greases 2:1303
 - interaction concerns 2:1303
 - sulfur-containing additives 2:1303
 - molybdenum additives 3:2159
 - organic coatings 4:2645, 4:2645*f*, 4:2653
 - wastewater treatment 3:1871
- adhesives
 - adhesive bond failure 3:2421, 3:2463
 - aluminum alloys 3:2000
 - structural adhesive joints 3:2463–2481
 - adhesive bond failure 3:2421, 3:2463
 - adhesively bonded substrate materials
 - aluminum substrates 3:2475, 3:2477*f*, 3:2478*f*, 3:2479*f*
 - aqueous solutions 3:2477*f*
 - general discussion 3:2473
 - low carbon steel substrates 3:2473, 3:2473*f*, 3:2475*f*, 3:2476*f*, 3:2477*f*
 - seawater 3:2476*f*
 - zinc substrates 3:2479
 - bond durability improvements 3:2480
 - failure mechanisms
 - adhesive plasticization 3:2465, 3:2466*f*
 - classifications 3:2469
 - corrosion-induced failures 3:2466
 - hydrodynamic displacement 3:2464, 3:2464*f*, 3:2465*f*
 - general discussion 3:2480
 - rubber–to–metal bonding 3:2421
- advanced technical ceramics 3:2282–2305
 - applications
 - biomedical devices 3:2303
 - chemical process vessels 3:2302
 - flow–meter bodies 3:2303
 - food processing equipment 3:2303
 - rotating seals 3:2303
 - valves 3:2303
 - boron nitride (BN)
 - comparative attack rates 3:2302*f*
 - corrosion resistance 1:679, 3:2285

- advanced technical ceramics (*continued*)
 cubic boron nitride (CBN) 3:2301
 hexagonal boron nitride (HBN) 3:2301
 hydrolysis processes 3:2301f
 material types 3:2301
 engineering applications
 advantages 3:2282
 limitations 3:2284
 microstructure
 corrosion–erosion synergism 3:2286
 corrosion resistance 3:2284
 corrosivity 3:2285
 high-alumina ceramics 3:2284
 porosity 3:2284–2285
 subcritical crack growth 3:2285
 performance characteristics
 alumina (Al₂O₃)
 corrosion resistance 1:674, 3:2289, 3:2290r
 corrosion test results 3:2291t, 3:2293f
 dye penetration 3:2291f
 flexural strength 3:2292f
 spalling tendencies 3:2291f
 comparative attack rates 3:2302, 3:2302f
 nonoxide-based materials
 boron nitride (BN) 3:2285, 3:2301, 3:2302f
 silicon carbide (SiC) 1:675, 1:676f, 3:2297, 3:2302f
 silicon nitride (SiN) 3:2299, 3:2302f
 specialist materials 3:2301
 oxide-based materials
 alumina (Al₂O₃) 1:674, 3:2289
 aluminosilicates 3:2289, 3:2302f
 glass ceramics 3:2297, 3:2298f
 glasses 3:2296
 mullite 3:2296, 3:2302f
 porcelains 3:2289, 3:2302f
 zirconia (ZrO₂) 1:674, 3:2294, 3:2302f
 zirconia (ZrO₂)
 material types 3:2294
 stabilized zirconia 1:674, 3:2294
 tetragonal zirconia polycrystals (TZP) 3:2294, 3:2302f
 transformation toughened partially stabilized materials 3:2294, 3:2295f
 zirconium dioxide (ZrO₂) composites 3:2295
 selection guidelines 3:2303
 silicon carbide (SiC)
 chemical vapor deposition (CVD) silicon carbides 3:2299
 comparative attack rates 3:2302f
 corrosion resistance 1:675, 1:676f, 3:2285
 hot corrosion 1:675, 1:676f
 liquid phase sintered silicon carbides 3:2299
 material types 3:2297
 parabolic rate constant plot 1:677f
 partial pressure effects 1:676f
 penetration time–temperature plot 1:679f
 reaction-bonded silicon carbides 3:2297
 silicon carbide/titanium carbide (SiC/TiC) composites 3:2299
 sintered silicon carbides 1:677, 1:678f, 3:2298
 silicon nitride (SiN/Si₃N₄)
 comparative attack rates 3:2302f
 corrosion resistance 1:678
 hot corrosion 1:678–679
 material types 3:2299
 penetration time–temperature plot 1:679f
 reaction-bonded silicon nitrides 3:2300
 sintered silicon nitrides 3:2300
 testing procedures
 assessment techniques
 corrodant changes 3:2288
 cross-section changes 3:2287
 dye penetration 3:2288
 flexural strength 3:2288
 general discussion 3:2288
 hardness 3:2288
 mass change 3:2287
 surface texture changes 3:2288
 equipment 3:2287
 testing standards 3:2286, 3:2288
Aerobacter spp. 4:2949, 4:2920
 aerobic microorganisms 2:1172, 2:1173f
 aerosols
 characteristics 2:1059
 cloud nucleation 2:1062, 2:1063f
 compositions 2:1061
 deliquescent relative humidity (DRH) 2:1060, 2:1061r
 marine aerosols 2:1059, 2:1061, 2:1067
 pH 2:1061
 size distributions 2:1060f
 sources 2:1059
 surface moisture effects 2:1077
 transport mechanisms
 general discussion 2:1067
 ground roughness effects 2:1070f, 2:1070r
 ocean-produced aerosols 2:1069f
 rainfall effects 2:1067
 relative humidity (RH) 2:1067
 scale of movement 2:1065, 2:1067f
 surf-produced aerosols 2:1069f, 2:1070f
 wind speed effects 2:1067, 2:1069f, 2:1070f
 African mahogany 2:1325r
 Agateen™ lacquer 4:3331
 air-assisted airless spray application 4:2640
 air-borne pollutants 3:1715, 3:1715t, 3:1716f
 aircraft corrosion 4:3175–3197
 airframe corrosion
 corrosion types
 absence of applied stress 4:3177, 4:3178r
 crevice corrosion 4:3178t, 4:3179, 4:3180r
 filiform corrosion 4:3178t, 4:3179
 galvanic corrosion 4:3178t, 4:3179, 4:3180r
 general discussion 4:3177
 microbially-induced corrosion (MIC) 2:1181, 4:3177, 4:3178t, 4:3180r
 presence of applied stress 4:3178, 4:3178t
 stress corrosion cracking (SCC) 4:3178, 4:3178t, 4:3179, 4:3180r
 general discussion 4:3176
 in-service corrosion 4:3179
 operational environments 4:3176
 structural integrity degradation 4:3179, 4:3180r
 crevice corrosion 2:767
 in-service corrosion management
 aircraft washing and cleaning 4:3192
 corrosion removal methods 4:3193
 dehumidification 4:3195
 future trends 4:3196
 general discussion 4:3192
 inspection techniques 4:3193
 paint removal and repainting methods 4:3195
 reprotective treatments 4:3194, 4:3194t
 supplementary protective coatings 4:3195
 manufacturing-related corrosion management
 aluminum alloys
 design guidelines 4:3191r
 exfoliation 4:3181r
 materials selection 4:3180
 protective treatments 4:3184, 4:3185f
 stress corrosion cracking (SCC) 4:3180, 4:3182r
 threshold stresses 4:3181–3182, 4:3182r
 design guidelines 4:3190, 4:3191r
 final assembly and finishes 4:3191
 manufacturing strategies 4:3180
 materials selection
 aluminum alloys 4:3180
 composite materials 4:3184
 general discussion 4:3180
 high-strength steels 4:3182
 magnesium alloys 4:3183
 titanium alloys 3:2048, 4:3183
 protective treatments
 aluminum alloys 4:3184, 4:3185f
 composite materials 4:3190
 current methods 4:3184, 4:3184t
 high-strength steels 4:3186, 4:3187f
 magnesium alloys 4:3188, 4:3189f
 plating alternatives 4:3188r

- titanium alloys 3:2048, 4:3189, 4:3190^f
- wear/fretting resistant coatings 4:3190
- airless spray application 4:2639
- air spraying techniques 4:2610, 4:2638
- Alcaligenes* spp. 4:2920
- alcohols 3:1772, 3:1773^r, 3:2000, 4:2490, 4:2992^r
- aldehydes 4:2490, 4:2992^r
- algae
 - characteristics 2:1172
 - industrial heating and cooling systems 4:2943, 4:2949, 4:2950
- alkali corrosion 2:1191–1206
 - aluminum alloys 3:1999
 - cast iron 3:1767, 3:1767^f, 3:1768^f, 3:1768^r
 - copper/copper alloys 2:1204, 3:1963
 - glasses 3:2313
 - inhibitors 4:2908
 - nickel/nickel alloys
 - alloying element influences 2:1200^f
 - corrosion rates 2:1200, 2:1202^f, 2:1203^f
 - nickel–water system Pourbaix diagram 2:1201^f
 - temperature effects 2:1202^f
 - nonmetallic materials
 - elastomers 2:1205
 - inorganic materials 2:1205
 - reinforced plastics 2:1204
 - thermoplastic materials 2:1204
 - process equipment risk management 4:3217^f
 - silver (Ag) 2:1204
 - stainless steels
 - alloying element influences 2:1199^f, 2:1200^f
 - austenitic stainless steels 2:1198^f, 2:1199^f
 - composition effects 2:1197^r, 2:1201^r
 - corrosion potential 2:1196
 - corrosion rates 2:1198^f
 - duplex stainless steels 2:1199^f, 2:1202^f
 - general corrosion 3:1843, 3:1844^f
 - potentiodynamic polarization curves 2:1196^f
 - stress corrosion cracking (SCC) 2:1200, 3:1833
- steels
 - anodic polarization curves 2:1194^f
 - corrosion rates 2:1196^f
 - crevice corrosion 2:1194–1195, 2:1195^f
 - general discussion 2:1192
 - iron–water system Pourbaix diagram 2:1193^f
 - stress relief techniques 2:1194^f
 - temperature effects 2:1194^f, 2:1195^f
 - titanium/titanium alloys 2:1204
 - vitreous silica 3:2315
 - zirconium/zirconium alloys 2:1204, 3:2124
- alkaline cleaners 4:2486, 4:2486^r, 4:2487^f, 4:2487^r
- alkaline copper quat (ACQ) 2:1327
- alkaline soils 3:2087^r, 4:2563^r
- alkali–silica reaction (ASR) 3:2362, 3:2362^f
- alkyds 4:2652, 4:2995^r
- alligatoring 4:2730
- alloys
 - above-water fastener selection 2:847^f
 - acid pickling
 - chemical cleaning 4:2489
 - hydrochloric acid (HCl) 4:2992^r
 - nitric acid (HNO₃) 4:2993^r
 - sulfuric acid (H₂SO₄) 4:2992^r
 - aluminum (Al) 3:1974–2010
 - acid pickling
 - hydrochloric acid (HCl) 4:2992^r
 - phosphoric acid (H₃PO₄) 4:2993^r
 - sulfuric acid (H₂SO₄) 4:2992^r
 - aircraft corrosion
 - airframe corrosion 4:3178^r
 - corrosion-resistant alloys 4:3184^r
 - design guidelines 4:3191^r
 - exfoliation 4:3181^r
 - materials selection 4:3180
 - plating methods 4:3188^r
 - protective treatments 4:3184, 4:3185^f
 - reprotective treatments 4:3194^r
 - stress corrosion cracking (SCC) 4:3180, 4:3182^r
 - threshold stresses 4:3181–3182, 4:3182^r
 - alloy designation systems
 - cast aluminum alloys 3:1980^r
 - copper/copper–magnesium-containing alloys 3:1981
 - 8xxx alloys 3:1982
 - general discussion 3:1979
 - lithium-containing alloys 3:1981
 - magnesium-containing alloys 3:1980
 - magnesium–silicon/silicon-containing alloys 3:1981
 - manganese-containing alloys 3:1979
 - pure aluminum 3:1979
 - temper designations 3:1980^r
 - wrought aluminum alloys 3:1980^r
 - zinc/zinc–magnesium-containing alloys 3:1981
 - aluminum–copper (Al–Cu) alloys 1:68^f
 - aluminum–lithium (Al–Li) alloys 2:930^f
 - applications 3:2007
 - atmospheric conditions 2:1086, 2:1087^f
 - automotive industry 4:3170
 - carburization 1:551, 1:639
 - cast iron corrosion 3:1773
 - characteristics
 - alloy designation systems 3:1979, 3:1980^r
 - cast aluminum alloys 3:1980^r, 3:1983, 3:1983^r
 - mechanical properties 3:1977, 3:1983^r
 - physical properties 3:1982, 3:1982^r, 3:1983^r
 - temper designations 3:1980^r
 - wrought aluminum alloys 3:1980^r, 3:1982, 3:1983^r
 - cobalt-based alloys 3:1918^r
 - cobalt–chromium–aluminum–yttrium (CoCrAlY) alloys 1:537^f, 1:631
 - cobalt–nickel–chromium–aluminum–yttrium (CoNiCrAlY) alloys 1:537^f, 4:2552
 - compositions 1:246^r
 - corrosion fatigue 2:947, 2:948^f
 - corrosion prevention strategies
 - anodized coatings 3:2005, 3:2006^f
 - cleaning 3:2003, 4:3319–3320
 - conversion coatings 3:2002
 - corrosion susceptibility 3:2003, 3:2003^f
 - grinding effects 3:2004, 3:2005^f
 - inhibitors 3:2001
 - organic coatings 3:2006
 - pretreatment options 3:2002
 - corrosion removal methods 4:3322, 4:3323^f
 - corrosivity
 - acid corrosion 3:1998, 3:1999^f
 - alkali corrosion 3:1999
 - alloy processing influences 3:1996
 - atmospheric corrosion 3:1996
 - bimetallic corrosion 3:1988
 - chemical environments 3:1998
 - corrosion potential 3:1988^r, 3:1991^r
 - crevice corrosion 3:1989
 - early stage corrosion 3:1991^f
 - environmentally-assisted cracking 3:1993
 - exfoliation 3:1993
 - filiform corrosion 2:996^f, 2:999, 2:999^f, 2:1000^f, 3:1990
 - forms and causes 3:1986
 - galvanic corrosion 3:1988
 - general dissolution 3:1986
 - high-temperature corrosion 3:2000
 - inorganic salts 3:1999
 - intergranular corrosion 3:1992, 3:1993^f
 - intermetallic particles 3:1990, 3:1991^r
 - marine environments 2:1138
 - microstructure effects 3:1990, 3:1991^r
 - organic compounds 3:2000
 - pitting corrosion 3:1986, 3:1988^f, 3:1991^f
 - potential–pH (Pourbaix) diagram 3:1987^f
 - protective oxidation films 3:1978^f, 3:1979^f, 3:1986
 - soil corrosion 3:1998
 - water corrosion 3:1997
 - current markets 3:2007
 - electroplated coatings 4:2578, 4:2590
 - environmentally-assisted cracking
 - corrosion fatigue 3:1995, 3:1996^f

- alloys (*continued*)
- hydrogen embrittlement 3:1996
 - liquid metal embrittlement (LME) 3:1995, 3:1995*f*
 - stress corrosion cracking (SCC) 3:1993, 3:1994*f*, 3:1995*t*
 - erosion resistance 2:985*f*
 - ferritic chromium steels 1:501*t*
 - filiform corrosion 2:996*f*
 - galvanic corrosion 2:831*f*, 2:851*t*, 2:852*t*, 2:1119*f*
 - general discussion 3:1975
 - global production 3:1976
 - high-temperature corrosion
 - applied stress conditions 3:2001
 - dry atmospheres 3:2000
 - high-temperature aqueous systems 3:2000
 - molten salts and metals 3:2000
 - nonmetal material contact 3:2000
 - historical background 3:1975
 - intergranular corrosion 2:814, 2:821*t*
 - iron–aluminum (Fe–Al) alloys 1:292, 1:452, 1:613*f*, 1:636*f*
 - iron–chromium–aluminum (Fe–Cr–Al) alloys
 - alloy grain size effects 1:616*f*
 - base metal oxide formation 1:619*f*
 - cubic alumina phases 1:620*f*, 1:621*f*
 - cycle frequency effects 1:632, 1:632*f*, 1:633*f*
 - internal oxidation 1:633, 1:634*f*
 - metal dusting 1:292
 - nitridation processes 1:639
 - parabolic rate constants 1:622*t*, 1:624*t*
 - reactive element additions 1:227*t*
 - scale adhesion 1:628*f*
 - scale growth rate 1:546*f*, 1:621, 1:622*f*, 1:623*f*
 - scale morphology 1:626, 1:627*f*
 - specimen mass gain 1:623*f*
 - sulfidation 1:552*f*, 1:638
 - sulfur impurities 1:230, 1:231*f*
 - water vapor effects 1:637
 - laser cladding (LC) 4:2624, 4:2633*t*
 - laser gas nitriding (LGS) 4:2632, 4:2632*f*
 - low-alloy steels 1:566
 - magnesium (Mg) 3:2013, 3:2016*t*, 3:2019*f*, 3:2019*t*
 - marine environments
 - corrosion rates 2:1139*t*
 - maximum depth of attack 2:1140*t*
 - pit depth measurements 2:1140*f*
 - wrought aluminum alloy designations 2:1139*t*
 - metal dusting 1:292
 - microscopy-based analytical techniques
 - aluminum–copper (Al–Cu) alloy oxide film 2:1410–1411, 2:1412*f*
 - electron backscatter diffraction (EBSD) 2:1413*f*
 - electron diffraction 2:1417, 2:1417*f*
 - electron energy loss spectroscopy (EELS) 2:1421, 2:1423*f*
 - electron probe microanalysis (EPMA) 2:1420, 2:1422*f*
 - heat-affected zone (HAZ) 2:1406*f*
 - high-resolution transmission electron microscopy (HRTEM) 2:1415, 2:1416*f*
 - scanning electron microscopy (SEM) 2:1410*f*, 2:1411*f*, 2:1415*f*
 - specimen preparation techniques 2:1424, 2:1425*f*
 - transmission electron microscopy (TEM) 2:1414*f*, 2:1415*f*, 2:1425*f*
 - X-ray analysis 2:1418, 2:1419*f*, 2:1420*f*
 - nickel–chromium–aluminum (Ni–Cr–Al) alloys
 - base metal oxide formation 1:617, 1:618*f*, 1:619*f*
 - compositions 1:609*t*, 1:693*t*
 - depletion profiles 1:695*f*
 - diffusion-controlled internal nitridation 1:307*f*
 - high-temperature oxidation 1:613, 1:614*f*, 1:692, 1:693*f*
 - nitridation processes 1:639
 - oxide map 1:614*f*
 - platinum-group metal effects 1:616
 - specimen mass gain 1:619*f*
 - thermodynamic stability 1:308, 1:308*f*
 - nickel–chromium–aluminum–yttrium (NiCrAlY) alloys 1:615–616, 1:632*f*, 1:639
 - nickel–cobalt–aluminum–yttrium (NiCoAlY) alloys 4:2624–2625
 - oxidation processes
 - Auger depth profiles 1:216*f*
 - cross-section image 1:221*f*
 - diffusion rates 1:221, 1:222*f*
 - general discussion 1:215
 - isotope profiles 1:220*f*
 - oxidation rates 1:218, 1:219*f*
 - oxide growth mechanisms 1:219, 1:220*f*
 - reactive elements 1:224
 - scale adhesion 1:223, 1:223*f*
 - scale development 1:216, 1:216*f*
 - scale morphology 1:217*f*, 1:220*f*
 - pitting corrosion
 - cathodic polarization curves 2:795*f*
 - intergranular corrosion 2:795, 2:796*t*
 - marine environments 2:1138
 - pitting potentials 2:782*f*, 2:795, 2:796*t*
 - process equipment materials 4:3210*f*, 4:3211
 - processing techniques
 - continuous casting 3:1985
 - direct chill casting 3:1984
 - extrusion 3:1985
 - hot and cold rolling 3:1985
 - shape casting 3:1983
 - relative humidity threshold values 4:3315
 - sacrificial anodes 4:2767–2768, 4:2768*t*, 4:2772
 - silicon–aluminum (Si–Al) alloys 2:1440, 2:1441*f*
 - stainless steels 3:1811
 - strength comparisons 3:2388*f*
 - stress corrosion cracking (SCC) 2:867*t*, 3:1993, 3:1994*f*, 3:1995*t*
 - stress growth measurements 1:159*t*
 - sulfidation corrosion 1:551–552, 1:552*f*
 - sulfuric acid (H₂SO₄) environments 2:1242, 3:1999*f*
 - welding processes 3:2461
 - wrought aluminum alloy designations 2:1139*t*
- amorphous alloys 3:2192–2204**
- alloying element influences
 - corrosion rates 3:2199*f*
 - current density dissolution 3:2198*f*
 - molybdenum (Mo) 3:2198
 - phosphorus (P) 3:2196, 3:2198*f*
 - sputter-deposited alloy structures 3:2198*f*
 - anodic dissolution rates 3:2195, 3:2195*f*
 - background information 3:2192
 - bulk metallic glasses
 - corrosion behavior 3:2199
 - corrosion-resistant bulk metallic glasses 3:2200
 - zirconium (Zr)-based bulk metallic glasses 3:2199
 - enriched alloy layers 3:2196*f*, 3:2197*f*
 - extremely high corrosion resistance mechanisms 3:2194
 - hydrochloric acid (HCl) solution testing 3:2193, 3:2193*f*
 - iron–chromium (Fe–Cr) alloys 3:2194–2195, 3:2195*t*
 - material types 3:2193
 - nanocrystalline alloys
 - conventional corrosion-resistant materials 3:2202
 - corrosion behavior 3:2201
 - pitting potential 3:2201*f*
 - precipitated materials 3:2201
 - repassivation potential 3:2201*f*
 - passive films 2:727, 3:2194–2195, 3:2195*t*, 3:2196*f*
 - pitting corrosion 3:2193–2194, 3:2194*f*
 - antimony–lead (Sb–Pb) alloys 1:65*f*, 1:66*f*, 3:2055, 3:2055*t*
 - archaeological metals 4:3312–3313
 - atomic force microscopy (AFM) 2:1440, 2:1441*f*
 - below-water fastener selection 2:849*f*
 - borderline alloys 1:426, 1:452
 - carburation
 - alumina-forming alloys 1:551, 1:639
 - basic concepts 1:265
 - carbide precipitation zones 1:278*f*
 - carburation rates 1:269*f*
 - chromium carbide precipitation
 - iron–chromium (Fe–Cr) alloys 1:276*t*
 - nickel–chromium (Ni–Cr) alloys 1:277*t*
 - corrosion mechanisms 1:265
 - corrosion products prediction 1:266, 1:267*f*, 1:268*f*
 - diffusion paths 1:278*f*
 - equipment concerns 1:265
 - gas composition effects 1:267*f*, 1:268*f*
 - general discussion 1:267, 1:301
 - heat-resisting alloys

- aluminum effects 1:284, 1:285f
carbon effects 1:283
carburization rate constants 1:283t
environment-based alloy selection 1:551
molybdenum effects 1:283
niobium effects 1:284, 1:284f
post-carburization appearance 1:282f
protective treatments 1:284
reaction morphologies 1:282
silicon effects 1:283
internal carbides 1:277t
kinetic mechanisms 1:277, 1:279f, 1:279t
metal dusting
 adsorbed sulfur protection 1:300, 1:301f
 alumina-forming alloys 1:551, 1:639
 austenitic iron–nickel (Fe–Ni) alloys 1:296, 1:297
 background information 1:285
 carbon uptake kinetics 1:297f
 cementite decomposition 1:286–287, 1:287f, 1:288f
 cementite formation 1:285, 1:286f, 1:287f
 coating protection 1:300
 coke filaments 1:286, 1:287f
 coking rates 1:290f, 1:291f
 environmental conditions 1:402
 environment-based alloy selection 1:551
 ferritic chromium steels 1:291, 1:292f, 1:293f
 gas composition effects 1:288, 1:290f, 1:297
 general discussion 1:301
 graphite–cementite interface 1:287, 1:289f
 Hochman–Grabke model 1:286f
 iron–aluminum (Fe–Al) alloys 1:292
 iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
 low-alloy steel 1:290, 1:290f, 1:291f
 mass transport model 1:287f
 nickel alloys 1:293, 1:294f, 1:295f, 1:296f, 1:297
 nickel–copper (Ni–Cu) alloys 1:296, 1:296f
 non-cementite iron dusting conditions 1:288, 1:289f
 oxide scale protection 1:298, 1:299f, 1:300f
 oxide to carbon conversion thermodynamics 1:300f
 risk management strategies 4:3224–3226, 4:3225f
 solid oxide fuel cells (SOFCs) 1:497
 temperature effects 1:288, 1:290f, 1:297
 microstructure characteristics 1:280, 1:280f, 1:281f
 partitioning effects 1:278f
 permeability data 1:276t, 1:279t
 phase diagram 1:278f
 rate variations 1:280f
 reaction morphologies 1:276
 thermochemistry 1:265
 thermodynamic properties 1:276
chromium (Cr) 1:583–605
 amorphous alloys 3:2193, 3:2197f, 3:2198f
 cast refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:603t
 cathodic modification
 general discussion 3:2230
 kinetic effects 3:2230
 noble metal additions 3:2230
 chromium–aluminum (Cr–Al) alloys 3:2198f
 chromium carbide precipitation 1:277t
 chromium–molybdenum (Cr–Mo) alloys 1:466f, 1:468f, 1:589
 chromium–niobium (Cr–Nb) alloys 1:549–550, 1:550f, 3:2198–2199, 3:2198f, 3:2199f, 3:2202
 chromium–tantalum (Cr–Ta) alloys 3:2198–2199, 3:2198f, 3:2199f
 chromium–titanium (Cr–Ti) alloys 3:2198f, 3:2199f
 chromium–zirconium (Cr–Zr) alloys 3:2198–2199, 3:2198f, 3:2199f, 3:2201
 cobalt-based alloys 3:1918, 3:1918t
 cobalt–chromium–carbon (Co–Cr–C) system 3:1920
 cobalt–chromium (CoCr) alloys 1:584, 1:586f, 1:593, 1:594f
 cobalt–chromium–molybdenum (CoCrMo) alloy
 corrosion fatigue 2:1318
 corrosion resistance 2:764, 2:1314, 3:1927
 crevice corrosion 2:1317
 galvanic corrosion 2:1319, 3:1928
 historical background 2:1310
 hydrogen embrittlement 2:1317
 pitting corrosion 2:1317
 replacement joints 2:1046f, 2:1047f
 zirconium (Zr)-based bulk metallic glasses 3:2200
 cobalt–chromium–tungsten (Co–Cr–W) system 3:1920
 compositions 1:246t
 copper–nickel–chromium (Cu–Ni–Cr) alloys 3:1943
 ferritic chromium steels
 anodic polarization curves 2:1231f
 erosion resistance 2:985f
 flow-induced corrosion 2:982f
 metal dusting 1:291, 1:292f, 1:293f
 solid oxide fuel cells (SOFCs) 1:492, 1:494t, 1:495f, 1:496f, 1:499, 1:501t
 general discussion 1:597
 growth behavior
 chromia (Cr₂O₃) growth 1:588
 high temperature corrosion protection 1:587
 spinel phase growth 1:588
 high chromium cast iron 3:1746, 3:1748f, 3:1764f
 high-silicon–chromium iron (Si–Cr–Fe) alloys (HSCI) 4:2784
 high temperature corrosion protection
 alloy types 1:584
 cobalt–chromium (Co–Cr) phase diagram 1:584, 1:586f
 growth behavior 1:587
 iron–chromium (Fe–Cr) phase diagram 1:584, 1:585f
 minor element influences 1:589
 nickel–chromium (Ni–Cr) phase diagram 1:584, 1:586f
 high temperature oxidation behavior
 austenitic stainless steels 1:591, 1:591f, 1:592f, 1:592t, 1:593f
 calculated partial pressures 1:590t
 cobalt–chromium (CoCr) alloys 1:593, 1:594f
 comparison studies 1:594, 1:594f, 1:595t, 1:596f, 1:597f
 general discussion 1:589
 global rating parameter (KB₄) 1:594, 1:596f
 martensitic and ferritic stainless steels 1:589, 1:590t
 metal loss/metal penetration studies 1:595t, 1:596f, 1:597f
 nickel–chromium (Ni–Cr) alloys 1:554f, 1:592, 1:593t
 nickel–iron–chromium (Ni–Fe–Cr) alloys 1:552f, 1:593, 1:593f, 1:594f
 solid oxygen fuel cell (SOFC) interconnectors 1:590t
 time to breakaway 1:590t
 weight gain 1:590f
 historical development 1:583
 intermetallic alloys
 alloyed aluminide coatings 1:663, 1:664f
 nickel aluminides (NiAl/Ni₃Al) 1:655–656
 titanium aluminides (TiAl/Ti₃Al) 1:658
 internal carbides 1:277t
 iron–40% chromium–platinum–group metals (Fe–40% Cr–PGM) system 3:2243
 iron–chromium–aluminum (Fe–Cr–Al) alloys
 alloy grain size effects 1:616f
 base metal oxide formation 1:619f
 cubic alumina phases 1:620f, 1:621f
 cycle frequency effects 1:632, 1:632f, 1:633f
 internal oxidation 1:633, 1:634f
 metal dusting 1:292
 nitridation processes 1:639
 parabolic rate constants 1:622t, 1:624t
 reactive element additions 1:227t
 scale adhesion 1:628f
 scale growth rate 1:546f, 1:621, 1:622f, 1:623f
 scale morphology 1:626, 1:627f
 specimen mass gain 1:623f
 sulfidation 1:552f, 1:638
 sulfur impurities 1:230, 1:231f
 water vapor effects 1:637
 iron–chromium (Fe–Cr) alloys
 breakaway oxidation mechanisms 1:428f, 1:430
 carbide precipitation zones 1:278f
 carburization diffusion paths 1:278f
 carburization kinetics 1:277, 1:279f, 1:279t
 carburization rate variations 1:280f
 cathodic modification 3:2231
 chromia (Cr₂O₃) scale growth mechanisms 1:419
 chromium carbide precipitation 1:276t
 compositions 1:609t
 corrosion rates 3:2232t

alloys (*continued*)

- external chromia scale formation 1:427, 1:429f
- internal carbides 1:277t
- internal oxidation 1:427, 1:428f
- noble metal additions 3:2231, 3:2241
- nonprotective oxidation 1:426
- passive films 2:727, 3:2194–2195, 3:2195t
- phase diagram 1:70f, 1:278f, 1:568f, 1:584, 1:585f
- polarization curves 3:2235f
- simulation techniques 2:1550f
- steam and steam/hydrogen environments 1:444f
- surface alloying processes 3:2240
- iron–chromium–molybdenum (Fe–Cr–Mo) alloys 3:2233, 3:2234t, 3:2241
- iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
- iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
- low-alloy steels 1:568, 1:568f
- maximum isothermal service temperature 1:585f
- metal–chromium–aluminum (MCrAl) alloys 1:613, 1:614f, 1:615f
- nickel–chromium–aluminum (Ni–Cr–Al) alloys
 - base metal oxide formation 1:617, 1:618f, 1:619f
 - compositions 1:609t, 1:693t
 - depletion profiles 1:695f
 - diffusion-controlled internal nitridation 1:307f
 - high-temperature oxidation 1:613, 1:614f, 1:692, 1:693f
 - nitridation processes 1:639
 - oxide map 1:614f
 - platinum-group metal effects 1:616
 - reactive element additions 1:227t
 - specimen mass gain 1:619f
 - sulfur impurities 1:230, 1:231f
 - thermodynamic stability 1:308, 1:308f
- nickel–chromium–aluminum–yttrium (NiCrAlY) alloys 1:615–616, 1:632f, 1:639
- nickel–chromium–cobalt (Ni–Cr–Co) alloys 1:250
- nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 - above-water fastener selection 2:847f
 - below-water fastener selection 2:849f
 - fireside corrosion 1:480f
 - galvanic corrosion 2:1119f
 - galvanic series 2:831f
 - general discussion 3:1886
 - hydrochloric acid (HCl) corrosion 2:1215f, 2:1216f
 - hydrofluoric acid (HF) corrosion 2:1214f
- nickel–chromium (Ni–Cr) alloys
 - alumina scale formation 1:623f
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1209f
 - carburation kinetics 1:279t
 - carburation rate variations 1:280f
 - chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421f
 - chromium carbide precipitation 1:277t
 - coefficients of thermal expansion (CTEs) 1:632f
 - corrosion resistance 3:1885, 3:1886f, 3:1900
 - galvanic corrosion 2:1119f
 - high temperature oxidation behavior 1:554f, 1:592, 1:593t
 - historical development 3:1882t
 - hydrofluoric acid (HF) corrosion 2:1214f
 - internal carbides 1:277t
 - internal nitridation processes 1:308–309, 1:309f
 - major alloying elements 3:1881, 3:1881t
 - minor alloying element addition effects 1:424f, 1:425f, 1:426f
 - molybdenum additives 3:2159
 - oxide overlay coatings 1:698f
 - scale adhesion 1:627, 1:628f
 - steam and steam/hydrogen environments 1:430, 1:431f, 1:432f
 - sulfidation corrosion 1:247f
 - time to breakaway 1:636f
 - vanadium attacks 1:472f
- nickel–iron–chromium (Ni–Fe–Cr) alloys
 - carbide precipitation zones 1:281f
 - carburation rate variations 1:280f
 - cast refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:603t
 - cathodic modification 3:2235
 - coke deposition 1:292f
 - galvanic corrosion 2:831f, 2:851t, 2:852t, 2:1119f
 - global rating parameter (KB₄) 1:594, 1:596f
 - high temperature oxidation behavior 1:552f, 1:593, 1:593f, 1:594f
 - intergranular corrosion 2:819
 - intragranular corrosion 2:1478
 - metal dusting 1:291, 1:292f, 1:293f
 - post-carburization appearance 1:282f
 - sulfidation corrosion 1:250
 - surface alloying processes 3:2240
 - wrought refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:599t, 1:600t
- noble metal additions 3:2231, 3:2241
- oxidation processes
 - general discussion 1:211
 - localized oxidation 1:212f
 - oxidation rates 1:211, 1:212f
 - oxide layer development 1:213, 1:213f, 1:215f
 - reactive elements 1:224
 - scale formation 1:213f
 - scale morphology 1:212f, 1:213f, 1:214, 1:215f
 - transport properties 1:211
- passivity 2:744
- quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
- refractory austenitic stainless steels 1:598t
- refractory ferritic stainless steels 1:597t
- scaling index 1:584t
- solid oxide fuel cells (SOFCs)
 - anode gas effects 1:494, 1:496f, 1:497f
 - anode-side interactions 1:510, 1:511f, 1:512f
 - behavior in hydrogen/water (H₂/H₂O)-based gases 1:488, 1:489f
 - carbonaceous gas formation 1:497, 1:498f
 - cathode-side interactions 1:507, 1:508f
 - component thickness effects 1:502, 1:503f, 1:504f, 1:505f
 - dual atmosphere conditions 1:507
 - electronic conductivity 1:492, 1:493f
 - equilibrium constants 1:488f
 - ferritic chromium steels 1:492, 1:494t, 1:495f, 1:496f, 1:499
 - gas compositions 1:497t
 - metal–glass sealant interactions 1:512, 1:513f
 - mixed-gas corrosion 1:489, 1:490f, 1:491f
 - oxidation rates 1:490, 1:492f
 - oxide dispersion strengthened (ODS) alloys 1:485, 1:486f, 1:487f
 - oxygen partial pressure effects 1:498f
 - scale formation 1:490f, 1:491f, 1:495f, 1:496f, 1:506f
 - vaporization protection methods 1:509, 1:510f, 1:511f
 - volatile species 1:485
- stainless steels 2:1232–1233, 2:1233f, 3:1809
- steam and steam/hydrogen environments
 - chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421f
 - chromia-forming iron- and nickel-based alloys 1:418, 1:420f
 - commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422f, 1:423f
 - minor alloying element addition effects 1:423, 1:424f, 1:425f, 1:426f
 - oxidation processes 1:418
 - spalling tendencies 1:419f
 - surface morphologies 1:423f
 - weight change comparisons 1:419f, 1:420f
- sulfidation corrosion 1:259f
- wrought refractory cobalt–chromium (Co–Cr) alloys 1:602t
- wrought refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:599t, 1:600t
- coatings
 - intermetallic alloys
 - alloyed aluminide coatings 1:663, 1:664f, 1:665f
 - aluminide coatings 1:663, 1:701, 1:701f
 - different base–different substrate 1:665, 1:665f
 - general discussion 1:662
 - laser cladding (LC) 4:2624, 4:2633t
 - same base–same substrate 1:663
 - simple aluminide coatings 1:663
 - uranium alloys 3:2188
 - metal–chromium–aluminum–yttrium (MCrAlY) coatings
 - characteristics 1:696
 - compositions 1:696t
 - microstructure 1:697f
 - structure 1:697f
 - titanium–aluminum (Ti–Al) alloys 1:697
- cobalt (Co)
 - alloying element influences 3:1918, 3:1920f
 - alumina-forming alloys 1:606–645

- alumina scale formation 1:623*f*
breakaway oxidation 1:634
compositions 1:607, 1:608*t*, 1:609*t*
creep rupture life 1:611*f*
environmental conditions 1:637
functionality 1:609*t*
general discussion 1:640
hydrogen permeability 1:612*f*
selective oxidation 1:612
spalled oxide mass 1:610*f*, 1:617*f*
steady-state oxidation 1:621
total mass gain 1:607, 1:610*f*, 1:614*f*, 1:617*f*
transient oxidation 1:617
- cobalt–chromium–aluminum–yttrium (CoCrAlY) alloys 1:537*f*, 1:631
cobalt–chromium–carbon (Co–Cr–C) system 3:1920
cobalt–chromium (CoCr) alloys 1:584, 1:586*f*, 1:593, 1:594*f*, 1:602*t*
cobalt–chromium–molybdenum (CoCrMo) alloy
corrosion fatigue 2:1318
corrosion resistance 2:764, 2:1314, 3:1927
crevice corrosion 2:1317
galvanic corrosion 2:1319, 3:1928
historical background 2:1310
hydrogen embrittlement 2:1317
pitting corrosion 2:1317
replacement joints 2:1046*f*, 2:1047*f*
zirconium (Zr)-based bulk metallic glasses 3:2200
- cobalt–chromium–tungsten (Co–Cr–W) system 3:1920
cobalt–nickel–chromium–aluminum–yttrium (CoNiCrAlY) alloys 1:537*f*, 4:2552
comparison studies 1:595*t*
compositions 1:246*t*
corrosion behavior 3:1924, 3:1926*f*, 3:1927*f*
flow-induced corrosion 2:982*f*
global rating parameter (KB_g) 1:596*f*
iron–nickel–cobalt (Fe–Ni–Co) alloys 1:551*f*
magnesium alloys 3:2016*t*
materials selection 2:982*f*
nickel-based superalloys 1:693*t*
nickel–chromium–cobalt (Ni–Cr–Co) alloys 1:250
nickel–cobalt–aluminum–yttrium (NiCoAlY) alloys 4:2624–2625
nitridation resistance 1:309*f*
process equipment materials 4:3211
processing techniques 3:1920
stacking fault energy 3:1919–1920, 3:1920*f*
stainless steels 3:1811
strengthening mechanisms 3:1922
superalloys 3:1918
wear effects 1:349
wrought refractory cobalt–chromium (Co–Cr) alloys 1:602*t*
- copper (Cu) 3:1937–1973
above-water fastener selection 2:847*f*
acid pickling
hydrochloric acid (HCl) 4:2992*t*
nitric acid (HNO₃) 4:2993*t*
sulfuric acid (H₂SO₄) 4:2992*t*
aluminum–copper (Al–Cu) alloys 1:68*f*
archaeological metals 4:3311*f*
background information 3:1938
below-water fastener selection 2:849*f*
cathodic protection 4:2755, 4:2755*t*
characteristics
aluminum bronzes 3:1943, 3:1952*t*
brasses 2:820, 3:1942, 3:1952*t*
cast copper alloys 3:1941*t*, 3:1942*t*, 3:1952*t*
copper–nickel–chromium (Cu–Ni–Cr) alloys 3:1943
cupronickel alloys 3:1942, 3:1952*t*, 3:1967
heat treatable copper alloys 3:1942
high conductivity coppers 3:1942
mechanical properties 3:1940*t*, 3:1942*t*
nickel silvers 3:1943, 3:1952*t*
physical properties 3:1940*t*
pure copper 3:1938
silicon bronzes 3:1943, 3:1952*t*
tin bronze 3:1943
wrought copper alloys 3:1939*t*, 3:1940*t*, 3:1952*t*
compositions 1:246*t*, 3:1939*t*, 3:1941*t*
contaminated environments
brass-product stress corrosion 3:1961
corrosivity 3:1960
stress corrosion cracking (SCC) 3:1962
copper–gold (Cu–Au) alloys 2:805*f*, 2:867*t*, 3:2215
copper–zinc (Cu–Zn) alloys 1:68*f*
corrosion potential 4:2591*t*
corrosion prevention strategies 4:3320
corrosive environments
atmospheric corrosion 3:1946, 3:1947*t*
contaminated environments 3:1960
freshwater environments 3:1954
general discussion 3:1946
high-temperature oxidation 3:1965
industrial chemicals 3:1962
internal corrosion risks 4:3217*f*, 4:3218*f*
natural water corrosion 3:1950
polluted conditions 3:1963, 3:1964*t*, 3:1965*f*
seawater 3:1958
soil corrosion 2:1158, 2:1159*f*, 3:1949, 3:1949*t*
- corrosivity
anhydrous hydrogen halide gases/hydrohalic acids 2:1214*f*, 2:1220, 2:1220*f*
crevice corrosion 3:1952*t*
electrode behavior 3:1944
electrode potential relationships 3:1944
potential–pH (Pourbaix) diagram 3:1945, 3:1945*f*
theoretical aspects 3:1943
dealloying mechanisms 2:802
electroplated coatings 4:2578
freshwater environments
chemical attacks 3:1956, 3:1956*f*
corrosivity 3:1954
dissolution conditions 3:1957
microbially-induced corrosion (MIC) 3:1956, 3:1957*f*
pipework systems 3:1954
pitting corrosion 3:1954
stress corrosion cracking (SCC) 3:1957, 3:1957*f*
- future developments
antimicrobial benefits 3:1967
cupronickel alloys 3:1967
shape-memory alloys 3:1968
hydrofluoric acid (HF) corrosion 2:1214*f*
industrial chemicals
acid corrosion 3:1963
alkali corrosion 2:1204, 3:1963
corrosivity 3:1962
hydrogen sulfide (H₂S) pollution 3:1963, 3:1964*t*, 3:1965*f*
neutral solutions 3:1963
organic compounds 3:1964
lead–copper (Pb–Cu) alloys 3:2055, 3:2055*t*
low-alloy steel 1:569
marine environments
corrosivity 2:1131, 3:1760*f*
critical design velocities 2:1132*t*
dealloying 2:1135
dissolved oxygen–corrosion rate plot 2:1134*f*
galvanic corrosion 2:1134–1135, 3:1757*t*
impingement attacks 2:1134
macrofouling 2:1133
metal-ion concentration cell corrosion 2:1135
pitting corrosion 2:1133–1134
self-corrosion 2:1135
shear stresses 2:1132*t*
stress corrosion cracking (SCC) 2:1135
sulfate-reducing bacteria (SRB) 2:1132–1133
temperature–corrosion rate plot 2:1133*f*
metal dusting 1:296, 1:296*f*
nickel–copper (Ni–Cu) alloys
corrosion protection methods 2:1143
corrosion resistance 3:1883
galvanic corrosion 2:831*f*, 2:854*t*, 2:1119*f*, 3:1845*f*
historical development 3:1882*t*
major alloying elements 3:1881, 3:1881*t*
marine environments 2:1131, 2:1132*t*, 2:1133*f*, 2:1134*f*, 2:1135
metal dusting 1:296, 1:296*f*
stress corrosion cracking (SCC) 2:867*t*

- alloys (*continued*)
- pitting corrosion
 - carbon film pitting 3:1955, 3:1955*f*
 - electrochemical processes 3:1955
 - freshwater environments 3:1954
 - hot soft water conditions 3:1955
 - natural waters 3:1954
 - Type III pitting 3:1955
 - Type II pitting 3:1955
 - Type I pitting 3:1955, 3:1955*f*
 - process equipment materials 4:3210*f*, 4:3211
 - protective treatments 3:1966, 4:3332, 4:3333*f*
 - silver–copper (Ag–Cu) alloys 1:67*f*
 - stainless steels 2:1232–1233, 2:1233*f*, 3:1809
 - sulfuric acid (H₂SO₄) environments 2:1243
 - uniform corrosion 2:729
 - water corrosion
 - brass dezincification 3:1952
 - contaminated environments 3:1960
 - freshwater environments 3:1954
 - impingement attacks 3:1950, 3:1951*f*, 3:1952*r*
 - natural waters 3:1950
 - pitting corrosion 3:1954
 - seawater 3:1952*r*, 3:1958
 - selective attacks 3:1954
 - wood 2:1326
 - corrosion fatigue
 - aluminum alloys 2:947, 2:948*f*
 - carbon steel 3:2457
 - ferrous alloys 2:944
 - stainless steels 2:946, 2:946*r*
 - titanium alloys 2:948
 - corrosion-resistant alloys
 - amorphous alloys 3:2192–2204
 - alloying element influences 3:2196
 - anodic dissolution rates 3:2195, 3:2195*f*
 - background information 3:2192
 - enriched alloy layers 3:2196*f*, 3:2197*f*
 - extremely high corrosion resistance mechanisms 3:2194
 - hydrochloric acid (HCl) solution testing 3:2193, 3:2193*f*
 - iron–chromium alloys 3:2194–2195, 3:2195*r*
 - material types 3:2193
 - passive films 2:727, 3:2194–2195, 3:2195*r*, 3:2196*f*
 - pitting corrosion 3:2193–2194, 3:2194*f*
 - body fluids 2:1311, 2:1312*f*
 - coatings 4:3184*r*
 - cobalt–chromium–molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
 - corrosion types
 - corrosion fatigue 2:944, 2:1318, 3:2049, 4:3178
 - crevice corrosion 2:1317, 4:3179
 - fretting corrosion 2:1318, 4:3178
 - galvanic corrosion 2:1319, 4:3179
 - general corrosion 2:1316
 - hydrogen embrittlement 2:1317, 4:3178
 - pitting corrosion 2:1317, 4:3177
 - stress corrosion cracking (SCC) 2:1317, 4:3178
 - dental amalgams 2:1316
 - design requirements 1:541–557
 - carburization 1:551
 - environment-based alloy selection 1:549
 - free energies 1:542*f*
 - general discussion 1:555
 - high-temperature environments 1:541
 - nitridation processes 1:549, 1:550*f*, 1:551*f*
 - oxidation lifetime maximization 1:547, 1:548*f*
 - protective oxidation 1:542, 1:542*f*, 1:543*f*
 - rare earth element additions 1:546, 1:546*f*, 1:547*f*
 - scale adhesion 1:546, 1:546*f*, 1:547*f*
 - scale formation 1:543, 1:543*f*, 1:545*f*
 - selective oxidation 1:543, 1:543*f*, 1:545*f*
 - steady-state oxidation 1:546
 - sulfidation corrosion 1:551–552, 1:552*f*, 1:554*f*
 - thermal expansion coefficients 1:548*f*
 - water vapor effects 1:553, 1:553*r*, 1:554*f*
 - health effects 2:1310, 2:1310*r*
 - historical background 2:1308
 - magnesium alloys 2:1315
 - metallic foams 2:1315
 - molybdenum additives 3:2159
 - nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
 - niobium (Nb) 3:2148
 - oral cavity 2:1312–1313
 - pipeline corrosion management 4:3296
 - porous materials 2:1315
 - rare earth magnets 2:1310, 2:1316
 - safety concerns 2:1308
 - stainless steels 2:764, 2:1314
 - stress corrosion cracking (SCC) 2:867*r*
 - surface finish 2:1313
 - tantalum (Ta) 3:2148
 - titanium nitride (TiN) coatings 2:1316
 - titanium/titanium alloys 2:764, 2:1310, 2:1313, 2:1317, 3:2164
 - crevice corrosion 2:759
 - dental fixtures 3:2220, 3:2220*r*
 - dispersion strengthened alloys 3:2209
 - 8xxx alloys 3:1982
 - electrochemical stability diagrams 2:1596
 - electroplated coatings 4:2578, 4:2590
 - erosion resistance 2:985*f*
 - fireside corrosion 1:466*f*, 1:472*f*, 1:480, 1:480*f*
 - gas turbines 1:525*r*
 - graphitic materials 3:2278
 - hafnium (Hf)
 - alumina-forming alloys 1:608*r*, 1:609*r*, 1:628, 1:630*f*
 - chromia-forming alloys 1:608*r*, 1:609*r*
 - heat-resisting alloys–carburization effects 1:284
 - intermetallic alloys 1:655, 1:659, 1:665
 - nickel-based superalloys 1:693*r*
 - zirconium–hafnium (Zr–Hf) alloys 3:2097*r*, 3:2098
 - heat-resisting alloys
 - carburization
 - aluminum effects 1:284, 1:285*f*
 - carbon effects 1:283
 - carburization rate constants 1:283*r*
 - environment-based alloy selection 1:551
 - molybdenum effects 1:283
 - niobium effects 1:284, 1:284*f*
 - post-carburization appearance 1:282*f*
 - protective treatments 1:284
 - reaction morphologies 1:282
 - silicon effects 1:283
 - internal nitridation processes
 - basic concepts 1:260
 - iron- and nickel-based superalloys 1:310, 1:311*f*
 - mechanical/kinetic effects 1:311, 1:312*f*
 - protective measures 1:312
 - nitridation processes
 - basic concepts 1:260
 - corrosion mechanisms 1:262
 - environment-based alloy selection 1:549, 1:550*f*, 1:551*f*
 - predictive modeling 1:261*f*, 1:262
 - pressure effects 1:263*f*, 1:264*f*, 1:265*f*
 - thermochemistry 1:262
 - transition stages 1:265*f*
 - high-temperature oxidation 1:180–194
 - alumina (Al₂O₃) scale growth 1:148
 - chromia (Cr₂O₃) scale growth 1:148, 1:413, 1:414*f*
 - exclusive scale growth criteria 1:191, 1:191*f*
 - fireside corrosion 1:466*f*
 - general discussion 1:180, 1:190, 1:193
 - internal oxidation 1:192
 - internal oxidation–external scale formation transition 1:193
 - nitridation processes
 - basic concepts 1:260
 - corrosion mechanisms 1:262
 - environment-based alloy selection 1:549, 1:550*f*, 1:551*f*
 - predictive modeling 1:261*f*, 1:262
 - pressure effects 1:263*f*, 1:264*f*, 1:265*f*
 - thermochemistry 1:262
 - transition stages 1:265*f*
 - oxide scale growth 1:146
 - parabolic rate constant plot 1:146*f*, 1:147*f*
 - Pilling–Bedworth ratio (PBR) 1:146*r*

- reactive element effects
 general discussion 1:146
 location detection 1:148
 oxide scale adherence 1:148
 oxide scale growth kinetics 1:147f, 1:148
 oxide scale growth mechanisms 1:148
 spalling tendencies 1:144
 thermal expansion coefficients 1:145f
 thermodynamics 1:190
 titanium–aluminum (Ti–Al) alloys 1:697
 hydrogen embrittlement 2:913
 Incoloy alloys
 characteristics 1:354
 ‘glaze’ formation 1:389, 1:391f
 Incoloy 800HT
 characteristics 1:355t
 Knoop hardness 1:357f
 Nimonic alloys 1:364, 1:366f, 1:367f
 wear effects 1:355, 1:356f, 1:358f, 1:359f, 1:360f, 1:361f, 1:363f, 1:368f
 weight change comparisons 1:355f, 1:362f
 load effects 1:358, 1:361f, 1:362f
 wear maps 1:394f, 1:395, 1:395f
 Inconel alloys 1:354
 intermetallic alloys 1:646–667
 aluminide coatings
 alloyed aluminide coatings 1:663, 1:664f, 1:665f
 different base–different substrate 1:665, 1:665f
 gas turbines 1:537f
 high-temperature coatings 1:701, 1:701f
 platinum aluminides 4:2544, 4:2545f, 4:2546f, 4:2547f, 4:2549f
 same base–same substrate 1:663
 simple aluminide coatings 1:663
 uranium alloys 3:2188
 applications 1:646
 coatings
 aluminide coatings 1:537f, 1:663, 1:701, 1:701f
 general discussion 1:662
 laser cladding (LC) 4:2624, 4:2633t
 common intermetallic alloys
 crystal structure 1:648f
 general discussion 1:646
 iron aluminides (FeAl/Fe₃Al) 1:292, 1:609t, 1:648, 1:648f, 1:650, 1:650f
 nickel aluminides (NiAl/Ni₃Al) 1:547f, 1:609t, 1:623f, 1:646, 1:648f, 1:649f, 1:650, 1:652f, 1:654f
 titanium aluminides (TiAl/Ti₃Al) 1:145f, 1:648f, 1:649, 1:651f
 copper–gold (Cu–Au) alloys 2:805f, 2:867t, 3:2215
 general discussion 1:646, 1:666
 high-temperature tribocorrosion
 characteristics 1:359
 silicon nitride (SiN/Si₃N₄) 1:355f, 1:360f, 1:364f, 1:365f, 1:371, 1:372f
 titanium–aluminum (Ti–Al)–ceramic counterfaces 1:362, 1:365f
 titanium–aluminum (Ti–Al)–metallic counterfaces 1:360, 1:363f, 1:364f
 hot corrosion
 alumina-forming alloys 1:638
 chlorine-containing environments 1:661, 1:662f
 general discussion 1:660
 sulfur-containing environments 1:660
 metal–matrix composites 3:2263, 3:2263t
 oxidation processes
 Ellingham diagram 1:652f
 general discussion 1:649
 iron aluminides (FeAl/Fe₃Al) 1:227t, 1:650
 nickel aluminides (NiAl/Ni₃Al) 1:227t, 1:547f, 1:623f, 1:650, 1:652f, 1:654f
 platinum aluminides 1:227t, 1:659
 titanium aluminides (TiAl/Ti₃Al) 1:656
 silver–gold (Ag–Au) alloys 2:803f, 2:805f, 2:806f, 2:867t, 3:2215
 structural metallurgy 1:63
 sulfur (S)
 gaseous environments 1:660
 impurities 1:230, 1:231f, 1:654–655
 molten salts 1:661, 1:661f
 thermal barrier coatings
 aeroengine applications 1:704f
 characteristics 1:664–665, 1:704
 chemical failures 1:719, 1:720f
 cross-section diagram 1:705f
 failure characteristics 1:713, 1:714f, 1:715f, 1:716f
 martensite formation 1:717
 mechanical instabilities 1:716f, 1:717
 oxidation-induced failure 1:712
 schematic cross-section diagram 1:705f
 strain energy 1:715
 subcritical crack growth 1:716, 1:721f
 surface roughness 1:718, 1:719f, 1:720, 1:720f, 1:721f
 time-to-failure data plot 1:713f
 topcoat cracking 1:716f, 1:721f
 transformation strains 1:716
 iron (Fe)
 alumina-forming alloys 1:606–645
 breakaway oxidation 1:634
 compositions 1:607, 1:608t, 1:609t
 creep rupture life 1:611f
 environmental conditions 1:637
 functionality 1:609t
 general discussion 1:640
 hydrogen permeability 1:612f
 selective oxidation 1:612
 spalled oxide mass 1:610f, 1:617f
 steady-state oxidation 1:621
 total mass gain 1:607, 1:610f, 1:614f, 1:617f
 transient oxidation 1:617
 austenitic iron–nickel (Fe–Ni) alloys 1:296, 1:297
 carburization
 dissolution thermodynamics 1:275t
 permeability data 1:276t
 reaction morphologies 1:276
 thermodynamic properties 1:276
 cast iron 3:1737–1788
 alcohol corrosion 3:1772, 3:1773t
 alkali corrosion 2:1192, 2:1196f, 3:1767, 3:1767f, 3:1768f, 3:1768t
 alloy cast irons 3:1740
 alloyed ferritic cast irons 3:1748, 3:1748f, 3:1756f, 3:1767t, 3:1770t, 3:1771f
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209, 2:1209f
 anodic protection 4:2876
 atmospheric corrosion 3:1750, 3:1751t, 3:1752f, 3:1752t
 austenitic cast irons 3:1748, 3:1749t, 3:1764f, 3:1768f, 3:1784t
 austenitic nickel cast iron 3:1744, 3:1744f, 3:1745t, 3:1756t
 cavitation corrosion 3:1777, 3:1777t
 characteristics 3:1739
 compositions 3:1741t
 corrosion fatigue 3:1768, 3:1769t, 3:1770f, 3:1770t, 3:1771f, 3:1772f
 corrosion rates 2:1196f
 corrosion removal methods 4:3321–3322
 ductile cast iron 3:1740, 3:1740f, 3:1752t, 3:1769t
 erosion corrosion 3:1778, 3:1779f, 3:1780f, 3:1780t
 erosion resistance 2:985f
 flow-induced corrosion 3:1777
 food product corrosion 3:1773, 3:1773t
 galvanic corrosion 2:831f, 2:849f, 2:851t, 2:982f, 2:1119f, 3:1845f
 galvanic coupling effects 3:1743, 3:1756, 3:1757t
 gaseous environments 3:1780
 glycol corrosion 3:1772, 3:1773t
 gray cast iron 3:1739, 3:1739f, 3:1741f, 3:1751t, 3:1756t, 3:1759t, 3:1769t, 3:1773t
 high-alloy cast irons 3:1744
 high chromium cast iron 3:1746, 3:1748f, 3:1764f
 high silicon cast iron 3:1746, 3:1747t, 3:1748t
 high-temperature oxidation 3:1780, 3:1781f, 3:1782f, 3:1783f, 3:1784f
 historical background 3:1695
 hydrochloric acid (HCl) corrosion 3:1765, 3:1765f, 3:1765t
 impressed current anodes 4:2782
 industrial environments 3:1763
 iron-oxidizing bacteria 3:1775
 liquid aluminum/aluminum alloy corrosion 3:1773
 liquid metals 3:1774
 liquid sulfur corrosion 3:1774, 3:1774t
 liquid zinc/zinc alloy corrosion 3:1774
 low-alloy lamellar cast irons 3:1742f, 3:1743, 3:1752f, 3:1759t
 malleable cast iron 3:1740, 3:1751t, 3:1752t
 marine corrosion 2:1125, 2:1125t

- alloys (*continued*)
- microbially-induced corrosion (MIC) 3:1774
 - microstructural effects 3:1741, 3:1741f, 3:1742f
 - mineral acid corrosion 3:1766
 - molten materials corrosion 3:1773
 - natural water corrosion 3:1752
 - nickel-resist cast irons 3:1750, 3:1753f, 3:1753t, 3:1760f, 3:1761f, 3:1762t, 3:1765t
 - nitric acid (HNO₃) corrosion 3:1765, 3:1766f
 - organic acid corrosion 3:1766, 3:1767t
 - organic compound corrosion 3:1772
 - phosphoric acid (H₃PO₄) corrosion 3:1765, 3:1766f, 3:1767t
 - production processes 3:1740
 - protective measures 3:1762
 - salt solutions 3:1768, 3:1768t, 3:1769t
 - seawater corrosion 2:1125, 2:1125t, 3:1758
 - soil corrosion 2:1152f, 3:1760, 3:1762t
 - spheroidal graphite cast irons 3:1743, 3:1759t
 - standard reduction potential 3:2074t
 - steam environments 3:1757
 - stress corrosion cracking (SCC) 3:1770, 3:1772f
 - stress growth measurements 1:159t
 - sulfate-reducing bacteria (SRB) 2:1175, 2:1176f, 3:1775
 - sulfuric acid (H₂SO₄) 2:1228, 2:1228f, 2:1229f
 - sulfuric acid (H₂SO₄) corrosion 3:1761f, 3:1762f, 3:1763, 3:1764f
 - sulfuric acid (H₂SO₄) effects 3:1743f
 - unalloyed cast irons 3:1747, 3:1756t, 3:1760f, 3:1761f, 3:1768f, 3:1768t, 3:1784t, 3:1785t, 3:1786t
 - urban/rural/marine atmospheres 3:1751t
 - vitreous enamel coatings 3:2331
 - white cast iron 3:1739, 3:1751t
 - comparison studies 1:595t
 - compositions 1:246t
 - corrosion fatigue 2:944
 - ferritic chromium steels
 - anodic polarization curves 2:1231f
 - erosion resistance 2:985f
 - flow-induced corrosion 2:982f
 - metal dusting 1:291, 1:292f, 1:293f
 - solid oxide fuel cells (SOFCs) 1:492, 1:494t, 1:495f, 1:496f, 1:499, 1:501t
 - high-silicon-chromium iron (Si-Cr Fe) alloys (HSCl) 4:2784
 - Incoloy alloys 1:354
 - iron-40% chromium-platinum-group metals (Fe-40% Cr-PGM) system 3:2243
 - iron aluminides (FeAl/Fe₃Al)
 - alumina scale formation 1:654
 - characteristics 1:648
 - chlorine-containing environments 1:661
 - compositions 1:609t
 - crystal structure 1:648f
 - metal dusting 1:292
 - microstructure 1:651
 - partial pressure effects 1:654
 - phase diagram 1:650f
 - porosity 1:651
 - reactive element additions 1:227t, 1:655
 - scale adhesion 1:223
 - scale properties 1:650
 - sulfur-containing environments 1:660
 - sulfur impurities 1:230, 1:231f, 1:654-655
 - water vapor effects 1:654
 - iron-aluminum (Fe-Al) alloys 1:292, 1:452, 1:613f, 1:636f
 - iron- and nickel-based superalloys 1:310, 1:311f
 - iron-carbon (Fe-C) alloys
 - equilibrium microstructures 3:1697, 3:1698f
 - mechanical properties 3:1699, 3:1699t
 - nonequilibrium microstructures 3:1697, 3:1698f
 - phase diagram 3:1695, 3:1696f
 - physical properties 3:1699, 3:1699t
 - iron-chromium-aluminum (Fe-Cr-Al) alloys
 - alloy grain size effects 1:616f
 - base metal oxide formation 1:619f
 - cubic alumina phases 1:620f, 1:621f
 - cycle frequency effects 1:632, 1:632f, 1:633f
 - internal oxidation 1:633, 1:634f
 - metal dusting 1:292
 - nitridation processes 1:639
 - parabolic rate constants 1:622t, 1:624t
 - reactive element additions 1:227t
 - scale adhesion 1:628f
 - scale growth rate 1:546f, 1:621, 1:622f, 1:623f
 - scale morphology 1:626, 1:627f
 - specimen mass gain 1:623f
 - sulfidation 1:552f, 1:638
 - sulfur impurities 1:230, 1:231f
 - water vapor effects 1:637
 - iron-chromium (Fe-Cr) alloys
 - breakaway oxidation mechanisms 1:428f, 1:430
 - carbide precipitation zones 1:278f
 - carburization diffusion paths 1:278f
 - carburization kinetics 1:277, 1:279f, 1:279t
 - carburization rate variations 1:280f
 - cathodic modification 3:2231
 - chromia (Cr₂O₃) scale growth mechanisms 1:419
 - chromium carbide precipitation 1:276t
 - compositions 1:609t
 - corrosion rates 3:2232t
 - external chromia scale formation 1:427, 1:429f
 - internal carbides 1:277t
 - internal oxidation 1:427, 1:428f
 - noble metal additions 3:2231, 3:2241
 - nonprotective oxidation 1:426
 - passive films 2:727, 3:2194-2195, 3:2195t
 - phase diagram 1:70f, 1:278f, 1:568f, 1:584, 1:585f
 - polarization curves 3:2235f
 - simulation techniques 2:1550f
 - steam and steam/hydrogen environments 1:444f
 - surface alloying processes 3:2240
 - iron-chromium-molybdenum (Fe-Cr-Mo) alloys 3:2233, 3:2234t, 3:2241
 - iron-chromium-nickel-manganese (Fe-Cr-Ni-Mn) alloys 3:2236
 - iron-chromium-nickel-molybdenum (Fe-Cr-Ni-Mo) alloys 3:2236
 - iron-nickel-cobalt (Fe-Ni-Co) alloys 1:551f
 - iron-nickel (Fe-Ni) alloys 3:1789-1801
 - acid corrosion 3:1792, 3:1792t
 - atmospheric corrosion 3:1790, 3:1791f, 3:1791t
 - carburization 1:296, 1:297
 - diffusion coefficients 1:307t
 - electrochemistry 3:1790, 3:1790f
 - fireside corrosion 1:472f
 - freshwater environments 3:1791
 - galvanic corrosion 3:1793, 3:1794t
 - general discussion 3:1790
 - industrial environments 3:1792
 - nitridation processes 1:307t
 - phase diagram 1:70f
 - salt solutions 3:1792
 - seawater corrosion 3:1791, 3:1791t, 3:1792t
 - stress corrosion cracking (SCC) 3:1793, 3:1793t
 - iron-nickel-sulfur (Fe-Ni-S) alloys 1:244f, 1:245f
 - iron-silicon (Fe-Si) alloys 4:2783
 - metal dusting
 - background information 1:285
 - cementite decomposition 1:286-287, 1:287f, 1:288f
 - cementite formation 1:285, 1:286f, 1:287f
 - coke filaments 1:286, 1:287f
 - coking rates 1:290f, 1:291f
 - ferritic chromium steels 1:291, 1:292f, 1:293f
 - gas composition effects 1:288, 1:290f
 - graphite-cementite interface 1:287, 1:289f
 - Hochman-Grabke model 1:286f
 - iron-aluminum (Fe-Al) alloys 1:292
 - iron-chromium-aluminum (Fe-Cr-Al) alloys 1:292
 - low-alloy steel 1:290, 1:290f, 1:291f
 - mass transport model 1:287f
 - non-cementite iron dusting conditions 1:288, 1:289f
 - temperature effects 1:288, 1:290f
 - nickel-iron-chromium (Ni-Fe-Cr) alloys
 - carbide precipitation zones 1:281f
 - carburization rate variations 1:280f
 - cast refractory iron-nickel-chromium (Fe-Ni-Cr) alloys 1:603t
 - cathodic modification 3:2235
 - coke deposition 1:292f

- galvanic corrosion 2:831*f*, 2:851*t*, 2:852*t*, 2:1119*f*
 global rating parameter (KB_4) 1:594, 1:596*f*
 high temperature oxidation behavior 1:552*f*, 1:593, 1:593*f*, 1:594*f*
 intergranular corrosion 2:819
 intragranular corrosion 2:1478
 metal dusting 1:291, 1:292*f*, 1:293*f*
 post-carburization appearance 1:282*f*
 sulfidation corrosion 1:250
 surface alloying processes 3:2240
 wrought refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:599*t*, 1:600*t*
 nitridation resistance 1:309*f*
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 silicon–molybdenum iron (Si–Mo Fe) alloys 4:2784
- laser cladding (LC) 4:2624, 4:2633*t*
- lead (Pb)
 compositions 3:2055*t*
 impressed current anodes 4:2786, 4:2787*t*, 4:2814*t*, 4:2815
 lead–antimony (Pb–Sb) alloys 1:65*f*, 1:66*f*, 3:2055, 3:2055*t*
 lead–calcium (Pb–Ca) alloys 3:2055, 3:2055*t*
 lead–copper (Pb–Cu) alloys 3:2055, 3:2055*t*
 lead–silver (Pb–Ag) alloys 3:2055, 3:2055*t*, 4:2814*t*, 4:2815
 lead–tellurium (Pb–Te) alloys 3:2055, 3:2055*t*
 lead–tin (Pb–Sn) alloys 3:2055, 3:2055*t*
 process equipment materials 4:3211
 sulfuric acid (H_2SO_4) environments 2:1244, 2:1245*f*
- magnesium (Mg) 3:2011–2041
 aircraft corrosion
 airframe corrosion 4:3178*t*
 corrosion behavior 4:3183
 design guidelines 4:3191*t*
 plating methods 4:3188*t*
 protective treatments 4:3184*t*, 4:3188, 4:3189*f*
 reproprotective treatments 4:3194*t*
- applications
 automotive industry 3:2037, 3:2038*f*
 communication industry 3:2038*f*
 current applications 3:2014*f*
 potential applications 3:2011
- biomedical devices 2:1315
- characteristics
 alloy compositions 3:2018*t*
 alloy designation systems 3:2015, 3:2019*t*
 alloying elements 3:2013, 3:2016*t*, 3:2019*f*
 binary alloy systems 3:2015*t*
 cast magnesium alloys 3:2017, 3:2020*t*, 3:2021*t*, 3:2023*f*
 electrolyte composition 3:2014*t*
 extraction processes 3:2013
 metallurgical properties 3:2013
 metal matrix composites (MMCs) 3:2020
 physical properties 3:2014*t*, 3:2017*t*
 raw material sources 3:2013*t*
 temper designations 3:2020*t*
 wrought magnesium alloys 3:2019, 3:2021*t*, 3:2022*t*, 3:2024*f*
- coatings
 anodic films 3:2034, 3:2035*f*, 3:2035*t*, 3:2036*f*
 chemical vapor deposition (CVD) 3:2036
 chromate conversion coatings (CCC) 3:2033
 coating systems and design 3:2037
 corrosion prevention strategies 3:2033
 electrochemical conversion coatings 3:2034, 3:2035*f*, 3:2035*t*, 3:2036*f*
 electro/electroless deposition 3:2034, 3:2036*f*
 electron beam deposition techniques 3:2036
 laser-applied coatings 3:2036
 organic coatings 3:2036
 thermal spraying 3:2036
- corrosion prevention strategies
 coatings 3:2033
 coating systems and design 3:2037
- corrosivity
 alloying process/impurities influences 3:2031, 3:2032*f*
 corrosion mechanisms 3:2026
 corrosion potential 3:2027*f*
 corrosion rates 3:2025*f*, 3:2032*f*
 electromotive force series (EMF series) 3:2026*f*
 environmentally-assisted cracking 3:2028
 general discussion 3:2025
 potential–pH (Pourbaix) diagram 3:2027*f*
 surface condition changes 3:2028*f*
- current applications 3:2014*f*
- environmentally-assisted cracking
 continuous crack propagation 3:2030*f*
 fracture surface appearance 3:2030*f*, 3:2031*f*
 friction stir weldment (FSW) 3:2031*f*
 open circuit potential (OCM) 3:2032*f*
 processing condition effects 3:2031*f*
 slow strain rate tensile (SSRT) tests 3:2029*f*, 3:2030*f*, 3:2031*f*
 stress corrosion cracking (SCC) 3:2030*t*, 3:2028
 stress–strain plots 3:2029*f*, 3:2031*f*, 3:2032*f*
 susceptibility 3:2030*t*
 transgranular cracking model 3:2030*f*
- galvanic corrosion 2:851*t*, 2:852*t*
 global production trends 3:2012*f*
 historical development 3:2012
- laser cladding (LC) 4:2624, 4:2633*t*
 magnesium–tin (Mg–Sn) alloys 1:67*f*
 pitting corrosion potential 2:782*f*
 potential applications 3:2011
- processing techniques
 casting technologies 3:2021, 3:2023*f*
 joining technologies 3:2023, 3:2025*f*
 metal forming processes 3:2022, 3:2024*f*
 welding 3:2023, 3:2025*f*
- sacrificial anodes 4:2769, 4:2769*t*, 4:2773
- scanning electron microscopy (SEM) analysis 2:1411*f*
- manganese (Mn)
 alumina-forming alloys 1:608*t*, 1:609*t*
 aluminum alloys 3:1979
 chromia-forming alloys 1:424*f*, 1:425*f*, 1:426*f*, 1:608*t*, 1:609*t*
 chromium-containing alloys 1:584*t*, 1:589
 compositions 1:246*t*
 ferritic chromium steels 1:501*t*
 iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
 low-alloy steels 1:567
 magnesium alloys 3:2015, 3:2016*t*, 3:2019*t*
 manganese bronze 2:831*f*, 2:849*f*, 2:1119*f*
 sacrificial anodes 4:2769
 stainless steels 3:1810
- metal dusting
 background information 1:285
 cementite decomposition 1:286–287, 1:287*f*, 1:288*f*
 cementite formation 1:285, 1:286*f*, 1:287*f*
 coke filaments 1:286, 1:287*f*
 coking rates 1:290*f*, 1:291*f*
 environmental conditions 1:402
 environment-based alloy selection 1:551
 ferritic chromium steels 1:291, 1:292*f*, 1:293*f*
 gas composition effects 1:288, 1:290*f*
 graphite–cementite interface 1:287, 1:289*f*
 Hochman–Grabke model 1:286*f*
 iron–aluminum (Fe–Al) alloys 1:292
 iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
 low-alloy steel 1:290, 1:290*f*, 1:291*f*
 mass transport model 1:287*f*
 non-cementite iron dusting conditions 1:288, 1:289*f*
 risk management strategies 4:3224–3226, 4:3225*f*
 solid oxide fuel cells (SOFCs) 1:497
 temperature effects 1:288, 1:290*f*
- mixed-gas corrosion
 basic concepts 1:245
 corrosion mechanisms 1:250, 1:251*f*, 1:252*f*, 1:253*f*
 corrosion rate predictions 1:259*f*
 gas composition effects 1:259
 kinetic models 1:255, 1:255*f*, 1:256*f*, 1:259*f*
 laboratory simulations 1:250, 1:254*f*, 1:254*t*, 1:255*f*
 parabolic rate constant plot 1:256*f*
 phase stability diagram 1:257*f*, 1:258*f*
 pressure effects 1:259*f*, 1:260*f*
 steam concentration effects 1:260*f*
 sulfidation/oxidation mechanisms 1:249, 1:250*f*, 1:255*f*, 1:256*f*, 1:259*f*, 1:260*f*
 thermochemical models 1:247, 1:248*f*, 1:254*f*, 1:254*t*, 1:255*f*

- alloys (*continued*)
- molybdenum (Mo)
- amorphous alloys 3:2193–2194, 3:2194*f*, 3:2198, 3:2198*f*
 - aqueous corrosive environments 3:2163
 - characteristics 3:2161
 - chromium–molybdenum (Cr–Mo) alloys 1:466*f*, 1:468*f*, 1:589
 - cobalt-based alloys 3:1918, 3:1918*t*
 - cobalt–chromium–molybdenum (CoCrMo) alloy
 - corrosion fatigue 2:1318
 - corrosion resistance 2:764, 2:1314, 3:1927
 - crevice corrosion 2:1317
 - galvanic corrosion 2:1319, 3:1928
 - historical background 2:1310
 - hydrogen embrittlement 2:1317
 - pitting corrosion 2:1317
 - replacement joints 2:1046*f*, 2:1047*f*
 - zirconium (Zr)-based bulk metallic glasses 3:2200
 - compositions 1:246*t*
 - corrosion-resistant alloys 2:1308
 - heat-resisting alloys–carburization effects 1:283
 - intermetallic alloys 1:656, 1:658
 - iron–chromium–molybdenum (Fe–Cr–Mo) alloys 3:2233, 3:2234*t*, 3:2241
 - iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
 - low-alloy steel 1:569
 - nickel-based superalloys 1:693*t*
 - nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 - fireside corrosion 1:480*f*
 - galvanic corrosion 2:831*f*, 2:1119*f*
 - general discussion 3:1886
 - hydrochloric acid (HCl) corrosion 2:1215*f*, 2:1216*f*
 - hydrofluoric acid (HF) corrosion 2:1214*f*
 - nickel–molybdenum (Ni–Mo) alloys
 - corrosion resistance 3:1884, 3:1885*f*
 - galvanic corrosion 2:851*t*
 - historical development 3:1882*t*
 - intergranular corrosion 2:819
 - laser surface alloying (LSA) 4:2631
 - major alloying elements 3:1881, 3:1881*t*
 - time–temperature–notch impact energy diagram 3:1885*f*
 - quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 - silicon–molybdenum iron (Si–Mo Fe) alloys 4:2784
 - stainless steels 2:1232–1233, 2:1233*f*, 3:1809
 - thermal expansion coefficients 1:145*f*
 - Ti15Mo5Zr3Al alloy 2:1313, 3:2164
 - Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 - titanium molybdenum (TiMo) alloys 2:1312–1313
 - uranium–molybdenum (U–Mo) alloys 3:2182, 3:2182*t*
- nanocrystalline alloys
- conventional corrosion-resistant materials 3:2202
 - corrosion behavior 3:2201
 - pitting potential 3:2201*f*
 - precipitated materials 3:2201
 - repassivation potential 3:2201*f*
- nickel-free biomedical alloys 2:766
- nickel–iron–chromium (Ni–Fe–Cr) alloys
- intragranular corrosion
 - background information 2:1478
 - boiling nitric acid (HNO₃) test (Huey test) 2:1478, 2:1479*t*, 2:1480*f*
 - boiling sulfuric acid/copper sulfate (H₂SO₄/CuSO₄) tests 2:1479*t*, 2:1480*f*, 2:1481, 2:1482*f*
 - electrochemical potentiokinetic reactivation (EPR) test 2:1485, 2:1486*f*
 - electrochemical tests 2:1483, 2:1484*f*
 - electrolytic oxalic acid etching test 2:1483, 2:1483*f*, 2:1484*f*
 - maximum acceptable evaluation test rates 2:1480*t*
 - nitric acid–hydrofluoric acid (HNO₃–HF) test 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
 - sulfuric acid–iron sulfate (H₂SO₄–FeSO₄) test (Streicher test) 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
 - test potentials 2:1480*f*
 - test summary 2:1479*t*
- nickel (Ni)
- aircraft corrosion 4:3188*t*
 - alkali corrosion
 - alloying element influences 2:1200*f*
 - corrosion rates 2:1200, 2:1202*f*, 2:1203*f*
 - nickel–water system Pourbaix diagram 2:1201*f*
 - temperature effects 2:1202*f*
- alloy 59
- acetic acid production 3:1908
 - corrosion loss diagram 3:1888*f*
 - corrosion rates 3:1889*f*, 3:1905*f*, 3:1911*f*
 - corrosion resistance 3:1887, 3:1900
 - fine and specialty chemicals 3:1910
 - hydrochloric acid (HCl) isocorrosion diagram 3:1888*f*
 - hydrofluoric acid (HF) production 3:1907
 - major alloying elements 3:1881*t*
 - methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 - phosphoric acid (H₃PO₄) production 3:1906*f*
 - pitting resistance 3:1894*f*
 - pollution controls 3:1912
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1888*f*
 - sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 - tank transport studies 3:1912
 - thermal stability 3:1890*t*, 3:1891*f*
 - time–temperature–sensitization diagram 3:1891*f*
 - toluene di-isocyanate (TDI) 3:1909
 - vinyl chloride monomer (VCM) production 3:1908
- alloy 20
- corrosion resistance 3:1891
 - galvanic corrosion 2:831*f*, 2:1119*f*
 - historical development 3:1882*t*
 - hydrofluoric acid (HF) production 3:1907
 - major alloying elements 3:1881*t*
 - maximum depth of crevice attack 2:1128*t*
 - pitting resistance 3:1897*t*
 - sulfuric acid (H₂SO₄) environments 2:1238*f*
 - sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 625
- acrylic acid/acrylate ester production 3:1909
 - corrosion loss diagram 3:1888*f*
 - corrosion rates 3:1889*f*
 - corrosion resistance 3:1890, 3:1899
 - galvanic corrosion 2:849*f*
 - major alloying elements 3:1881*t*
 - nuclear waste isolation 2:767
 - phosphoric acid (H₃PO₄) production 3:1905
 - pitting resistance 3:1894*f*, 3:1900
 - sulfuric acid (H₂SO₄) isocorrosion diagram 2:1243*f*
 - thermal expansion coefficients 1:145*f*
 - time–temperature–sensitization diagram 3:1891*f*
 - vinyl chloride monomer (VCM) production 3:1908
- alloy 31
- acetic acid production 3:1908
 - acrylic acid/acrylate ester production 3:1909
 - corrosion loss measurements 3:1894*t*, 3:1895*t*
 - corrosion rates 3:1905*f*, 3:1911*f*
 - corrosion resistance 3:1892, 3:1900
 - fine and specialty chemicals 3:1910
 - historical development 3:1882*t*
 - hydrochloric acid (HCl) isocorrosion diagram 3:1894*f*
 - major alloying elements 3:1881*t*
 - phosphoric acid (H₃PO₄) production 3:1905, 3:1906*f*
 - pitting potential 3:1895*f*
 - pitting resistance 3:1894*f*, 3:1897*t*, 3:1900, 3:1901*t*
 - pollution controls 3:1912
 - stability limits 3:1895*f*
 - sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237*f*, 3:1893*f*
 - sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 - tank transport studies 3:1912
- alloy 33
- caustic soda (NaOH) production 3:1902, 3:1902*f*
 - corrosion loss measurements 3:1896*t*, 3:1897*t*
 - corrosion resistance 3:1892, 3:1896*f*
 - historical development 3:1882*t*
 - major alloying elements 3:1881*t*
 - pitting resistance 3:1894*f*, 3:1897*t*
 - sulfuric acid (H₂SO₄) environments 2:1238*f*
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897*f*
 - sulfuric acid (H₂SO₄) production and handling 3:1903

- alloy 400
 acrylic acid/acrylate ester production 3:1909
 alkali corrosion 2:1200*f*
 hydrofluoric acid (HF) production 2:1214*f*, 3:1907
 marine environments 2:1135, 2:1136*t*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 oxidizing environments 2:1240*f*
 styrene production 3:1908
 sulfuric acid (H₂SO₄) environments 2:1247*f*
 velocity factors 2:1241*f*
 vinyl chloride monomer (VCM) production 3:1908
- alloy 600
 alkali corrosion 2:1200*f*, 2:1202–1203, 2:1203*f*
 aqueous corrosive environments 2:1136*t*, 3:1902, 3:1908
 stress corrosion cracking (SCC) 2:867*t*
- alloy 617 3:1908
- alloy 690 2:1238*f*, 3:1896*t*
- alloy 800 2:1136*t*, 3:1908
- alloy 904L 2:1238*f*, 3:1897*t*, 3:1906*f*, 4:3059*t*, 4:3060*f*
- alloy 926
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 hydrofluoric acid (HF) production 3:1907
 phosphoric acid (H₃PO₄) production 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*
 pollution controls 3:1914
 stability limits 3:1895*f*
 styrene production 3:1908
 vinyl chloride monomer (VCM) production 3:1908
- alloy B-2 2:1238*f*, 2:1240*f*, 3:1903, 3:1907, 3:1908, 3:1909, 3:1911*f*, 4:3058*f*
- alloy C-276
 acetic acid production 3:1908
 acrylic acid/acrylate ester production 3:1909
 corrosion loss diagram 3:1888*f*
 corrosion rates 3:1889*f*
 corrosion resistance 3:1886, 3:1900
 galvanic corrosion 2:849*f*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 phosphoric acid (H₃PO₄) production 3:1906*f*
 pitting resistance 3:1894*f*, 3:1900
 pollution controls 3:1912
 styrene production 3:1908
 sulfuric acid (H₂SO₄) environments 2:1238*f*, 2:1240*f*, 2:1243*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1887*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 thermal expansion coefficients 1:145*f*
 thermal stability 3:1890*t*
 time-temperature-sensitization diagram 3:1891*f*
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1908
- alumina-forming alloys 1:606–645
 breakaway oxidation 1:634
 compositions 1:607, 1:608*t*, 1:609*t*
 creep rupture life 1:611*f*
 environmental conditions 1:637
 functionality 1:609*t*
 general discussion 1:640
 hydrogen permeability 1:612*f*
 selective oxidation 1:612
 spalled oxide mass 1:610*f*, 1:617*f*
 steady-state oxidation 1:621
 total mass gain 1:607, 1:610*f*, 1:614*f*, 1:617*f*
 transient oxidation 1:617
- anhydrous hydrogen halide gases/hydrohalic acids
 alloy 2000 2:1218*f*
 alloy B 2:1217*f*
 alloy B-3 2:1218*f*
 compositions 2:1213*t*
 corrosion rates 2:1212
 hydrobromic acid (HBr) 2:1217*f*
 hydrochloric acid (HCl) 2:1214*f*, 2:1215*f*, 2:1216*f*, 2:1217*f*, 2:1218*f*, 2:1220*f*
 hydrofluoric acid (HF) 2:1214*f*, 2:1219*f*
- aqueous corrosive environments 3:1879–1915
 acetic acid production 3:1907
 acrylic acid/acrylate ester production 3:1909
 age-hardenable nickel-chromium-iron-molybdenum-copper (Ni-Cr-Fe-Mo-Cu) alloys 3:1898
 alloy 28 3:1894*t*, 3:1895*f*, 3:1895*t*, 3:1896*t*, 3:1897*t*, 3:1905
 alloy 39 3:1911*f*
 alloy 200 3:1902, 3:1908
 alloy 201 3:1902, 3:1902*f*
 alloy 316 2:1238*f*, 2:1247*f*, 3:1897*t*
 alloy 600 2:1136*t*, 3:1902, 3:1908
 alloy 617 3:1908
 alloy 690 2:1238*f*, 3:1896*t*
 alloy 800 2:1136*t*, 3:1908
 alloy 904L 2:1238*f*, 3:1897*t*, 3:1906*f*, 4:3059*t*, 4:3060*f*
 alloy B-2 2:1238*f*, 2:1240*f*, 3:1903, 3:1907, 3:1908, 3:1909, 3:1911*f*, 4:3058*f*
 background information 3:1881
 caustic soda (NaOH) production 3:1902
 chemical process industry and environmental technology 3:1901
 fine and specialty chemicals 3:1910
 general discussion 3:1880
 heat-affected zone (HAZ) 3:1898, 3:1898*f*
 historical development 3:1882*t*
 hydrofluoric acid (HF) production 3:1907
 intercrystalline corrosion (IC) 3:1894–1895, 3:1900
 materials selection 2:982*f*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 nickel-chromium-iron-molybdenum-copper (Ni-Cr-Fe-Mo-Cu) alloys 3:1881, 3:1881*t*, 3:1882*t*, 3:1891
 nickel-chromium-molybdenum (Ni-Cr-Mo) alloys 3:1881, 3:1881*t*, 3:1882*t*, 3:1886
 nickel-chromium (Ni-Cr) alloys 3:1881, 3:1881*t*, 3:1882*t*, 3:1885, 3:1886*f*
 nickel-copper (Ni-Cu) alloys 2:1119*f*, 3:1881, 3:1881*t*, 3:1882*t*, 3:1883
 nickel-molybdenum (Ni-Mo) alloys 3:1881, 3:1881*t*, 3:1882*t*, 3:1884, 3:1885*f*
 phosphoric acid (H₃PO₄) production 3:1905
 pitting resistance 3:1900
 pollution controls 3:1912
 principal alloys 3:1881, 3:1881*t*
 styrene production 3:1908
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 surface conditions and treatment 3:1899
 tank transport studies 3:1912
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1886–1887, 3:1908
 welded-state corrosion behavior 3:1898
- austenitic iron-nickel (Fe-Ni) alloys 1:296, 1:297
- austenitic nickel cast iron 3:1744, 3:1744*f*, 3:1745*t*, 3:1756*t*
- brazed joints 3:2451
- carburization
 dissolution thermodynamics 1:275*t*
 permeability data 1:276*t*
 reaction morphologies 1:276
 thermodynamic properties 1:276
- cobalt-based alloys 3:1918*t*
- cobalt-nickel-chromium-aluminum-yttrium (CoNiCrAlY) alloys 1:537*f*, 4:2552
- comparison studies 1:595*t*
- compositions 1:246*t*, 2:1213*t*, 2:1242*t*
- copper-nickel-chromium (Cu-Ni-Cr) alloys 3:1943
- crevice corrosion 2:759–760
- cupronickel alloys 3:1942, 3:1952*t*, 3:1967
- diffusion coefficients 1:307*t*
- ferritic chromium steels 1:501*t*
- galvanic corrosion 3:1757*t*
- Inconel alloys 1:354
- intergranular corrosion 2:819, 2:823*t*, 2:825*t*
- internal corrosion risks 4:3217*f*, 4:3218*f*
- iron- and nickel-based superalloys 1:310, 1:311*f*
- iron-chromium-nickel-manganese (Fe-Cr-Ni-Mn) alloys 3:2236
- iron-chromium-nickel-molybdenum (Fe-Cr-Ni-Mo) alloys 3:2236

- alloys (*continued*)
- iron–nickel–cobalt (Fe–Ni–Co) alloys 1:551*f*
 - iron–nickel (Fe–Ni) alloys 3:1789–1801
 - acid corrosion 3:1792, 3:1792*t*
 - atmospheric corrosion 3:1790, 3:1791*f*, 3:1791*t*
 - carburization 1:296, 1:297
 - diffusion coefficients 1:307*t*
 - electrochemistry 3:1790, 3:1790*f*
 - fireside corrosion 1:472*f*
 - freshwater environments 3:1791
 - galvanic corrosion 3:1793, 3:1794*t*
 - general discussion 3:1790
 - industrial environments 3:1792
 - nitridation processes 1:307*t*
 - phase diagram 1:70*f*
 - salt solutions 3:1792
 - seawater corrosion 3:1791, 3:1791*t*, 3:1792*t*
 - stress corrosion cracking (SCC) 3:1793, 3:1793*t*
 - iron–nickel–sulfur (Fe–Ni–S) alloys 1:244*f*, 1:245*f*
 - low-alloy steels 1:568
 - maraging steels
 - acid corrosion 3:1795
 - applications 3:1800
 - atmospheric corrosion 3:1795, 3:1797*f*
 - compositions 3:1793, 3:1795*t*
 - fabrication processes 3:1794
 - industrial environments 3:1795
 - mechanical properties 3:1794, 3:1796*t*
 - natural environments 3:1795
 - physical properties 3:1795*t*
 - seawater corrosion 3:1795, 3:1797*f*
 - stress corrosion cracking (SCC) 3:1796
 - structural characteristics 3:1794
 - marine corrosion 2:1135, 2:1136*t*
 - metal dusting 1:293, 1:294*f*, 1:295*f*, 1:296*f*, 1:297
 - nickel aluminides (NiAl/Ni₃Al)
 - alumina scale formation 1:547*f*, 1:623*f*, 1:652*f*, 1:654*f*
 - aluminide coatings 1:665, 1:665*f*, 3:2188
 - characteristics 1:646
 - chlorine-containing environments 1:661
 - coefficients of thermal expansion (CTEs) 1:632*f*
 - compositions 1:609*t*
 - crystal structure 1:104, 1:648*f*
 - dislocations 1:106–107
 - internal oxidation 1:633
 - microstructure 1:651
 - parabolic rate constants 1:624*t*
 - partial pressure effects 1:654
 - phase diagram 1:649*f*
 - porosity 1:651
 - reactive element additions 1:227*t*, 1:655
 - scale adhesion 1:223
 - scale properties 1:650
 - sulfur-containing environments 1:660
 - sulfur impurities 1:230, 1:231*f*, 1:654–655
 - water vapor effects 1:637, 1:638*f*, 1:654
 - nickel–chromium–aluminum (Ni–Cr–Al) alloys
 - base metal oxide formation 1:617, 1:618*f*, 1:619*f*
 - compositions 1:609*t*, 1:693*t*
 - depletion profiles 1:695*f*
 - diffusion-controlled internal nitridation 1:307*f*
 - high-temperature oxidation 1:613, 1:614*f*, 1:692, 1:693*f*
 - nitridation processes 1:639
 - oxide map 1:614*f*
 - platinum-group metal effects 1:616
 - reactive element additions 1:227*t*
 - specimen mass gain 1:619*f*
 - sulfur impurities 1:230, 1:231*f*
 - thermodynamic stability 1:308, 1:308*f*
 - nickel–chromium–aluminum–yttrium (NiCrAlY) alloys 1:615–616, 1:632*f*, 1:639
 - nickel–chromium–cobalt (Ni–Cr–Co) alloys 1:250
 - nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
 - alloy 20 2:831*f*, 2:1119*f*, 2:1128*t*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*
 - alloy 825 2:767, 2:1238*f*, 2:1243*f*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*, 3:1908
 - alloy G-3 3:1881*t*, 3:1882*t*, 3:1891, 3:1894*t*, 3:1907
 - alloy G-30 2:1238*f*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1896*t*
 - corrosion resistance 3:1891
 - historical development 3:1882*t*
 - major alloying elements 3:1881, 3:1881*t*
 - nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 - above-water fastener selection 2:847*f*
 - alloy 22 2:767, 3:1881*t*, 3:1887, 3:1888*f*, 3:1890*t*, 3:1891*f*
 - alloy 686 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
 - alloy 2000 2:1241*f*, 2:1247*f*, 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
 - alloy C-4 1:145*f*, 3:1881*t*, 3:1887, 3:1888*f*, 3:1891*f*, 3:1900
 - alloy MAT 21 3:1881*t*, 3:1889
 - below-water fastener selection 2:849*f*
 - corrosion resistance 3:1886
 - fireside corrosion 1:480*f*
 - galvanic corrosion 2:1119*f*
 - galvanic series 2:831*f*
 - general discussion 3:1886
 - historical development 3:1882*t*
 - hydrochloric acid (HCl) corrosion 2:1215*f*, 2:1216*f*
 - hydrofluoric acid (HF) corrosion 2:1214*f*
 - intergranular corrosion 2:819
 - major alloying elements 3:1881, 3:1881*t*
 - nickel–chromium (Ni–Cr) alloys
 - alumina scale formation 1:623*f*
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1209*f*
 - carburization kinetics 1:279*t*
 - carburization rate variations 1:280*f*
 - chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421*f*
 - chromium carbide precipitation 1:277*t*
 - coefficients of thermal expansion (CTEs) 1:632*f*
 - corrosion resistance 3:1885, 3:1886*f*, 3:1900
 - galvanic corrosion 2:1119*f*
 - high temperature oxidation behavior 1:554*f*, 1:592, 1:593*t*
 - historical development 3:1882*t*
 - hydrofluoric acid (HF) corrosion 2:1214*f*
 - internal carbides 1:277*t*
 - internal nitridation processes 1:308–309, 1:309*f*
 - major alloying elements 3:1881, 3:1881*t*
 - mechanical properties 1:584
 - minor alloying element addition effects 1:424*f*, 1:425*f*, 1:426*f*
 - molybdenum additives 3:2159
 - oxide overlay coatings 1:698*f*
 - phase diagram 1:586*f*
 - scale adhesion 1:627, 1:628*f*
 - steam and steam/hydrogen environments 1:430, 1:431*f*, 1:432*f*
 - sulfidation corrosion 1:247*f*
 - time to breakaway 1:636*f*
 - vanadium attacks 1:472*f*
 - nickel–cobalt–aluminum–yttrium (NiCoAlY) alloys 4:2624–2625
 - nickel–copper (Ni–Cu) alloys
 - corrosion protection methods 2:1143
 - corrosion resistance 3:1883
 - erosion resistance 2:985*f*
 - flow-induced corrosion 2:982*f*
 - galvanic corrosion 2:831*f*, 2:854*t*, 2:1119*f*, 3:1845*f*
 - historical development 3:1882*t*
 - major alloying elements 3:1881, 3:1881*t*
 - marine environments 2:1131, 2:1132*t*, 2:1133*f*, 2:1134*f*, 2:1135
 - materials selection 2:982*f*
 - metal dusting 1:296, 1:296*f*
 - phase diagram 1:64*f*
 - stress corrosion cracking (SCC) 2:867*t*
 - nickel–iron–chromium (Ni–Fe–Cr) alloys
 - carbide precipitation zones 1:281*f*
 - carburization rate variations 1:280*f*
 - cast refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:603*t*
 - cathodic modification 3:2235
 - coke deposition 1:292*f*
 - galvanic corrosion 2:831*f*, 2:851*t*, 2:852*t*, 2:1119*f*
 - global rating parameter (KB₄) 1:594, 1:596*f*
 - high temperature oxidation behavior 1:552*f*, 1:593, 1:593*f*, 1:594*f*
 - intergranular corrosion 2:819
 - intragranular corrosion 2:1478
 - metal dusting 1:291, 1:292*f*, 1:293*f*
 - post-carburization appearance 1:282*f*
 - sulfidation corrosion 1:250

- surface alloying processes 3:2240
 wrought refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:599*t*, 1:600*t*
- nickel–molybdenum (Ni–Mo) alloys
 corrosion resistance 3:1884, 3:1885*f*
 galvanic corrosion 2:851*t*
 historical development 3:1882*t*
 intergranular corrosion 2:819
 major alloying elements 3:1881, 3:1881*t*
 time–temperature–notch impact energy diagram 3:1885*f*
- nickel-resist cast irons
 acetic acid corrosion 3:1767*t*
 characteristics 3:1750
 corrosion rates 3:1753*f*, 3:1753*t*
 gaseous environments 3:1785*t*, 3:1786*t*
 hydrochloric acid (HCl) corrosion 3:1765*t*
 salt solution corrosion 3:1768*t*, 3:1769*t*
 seawater corrosion 2:1125, 2:1125*t*, 3:1760*f*, 3:1761*f*, 3:1761*f*, 3:1762*t*
- nickel silvers 3:1943, 3:1952*t*
- nickel–sulfur (Ni–S) alloys 1:242, 1:243*f*, 1:245*f*
- nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
- nitridation resistance 1:309*f*
 process equipment materials 4:3210*f*, 4:3211
- quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
- scaling index 1:584*t*
- solid oxide fuel cells (SOFCs) 1:510, 1:511*f*, 1:512*f*
- stainless steels 2:1232–1233, 3:1809
- stress growth measurements 1:159*t*
- sulfate-reducing bacteria (SRB) 2:1178
- sulfuric acid (H₂SO₄)
 anodic polarization curves 2:1239*f*
 chloride contamination 2:1241*f*
 corrosion rates 2:1238, 2:1239*f*
 iron alloying influences 2:1240*f*
 oxidizing environments 2:1240*f*
 performance characteristics 2:1241, 2:1242*f*, 2:1242*t*, 2:1243*f*
 protection mechanisms 2:1238, 2:1239*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1242*f*, 2:1243*f*
 velocity factors 2:1241*f*
- superalloys
 compositions 1:693*t*
 high-temperature oxidation 1:692, 1:693*f*
 molybdenum additives 3:2159
- welding processes 3:2461
- Nimonic alloys
 coefficient of friction 1:380*f*
 'glaze' formation 1:379
 Incoloy 800HT counterfaces 1:366*f*, 1:367*f*
 load effects 1:366, 1:368*f*, 1:371
- Nimonic alloys–Stellite 6 wear-affected surfaces study
 aluminum oxide segregation 1:387*f*
 'glaze' formation 1:382*f*, 1:384*f*
 relevant element oxidation tendencies 1:389*f*
 scanning electron microscopy (SEM) 1:381*f*, 1:383
 scanning transmission electron microscopy (STEM) 1:383
 sliding wear comparisons 1:388*f*
 spectral data 1:392*t*
 structural characteristics 1:387, 1:390*f*, 1:391*f*
 wear effects 1:385*f*, 1:386*f*
 wear maps 1:393, 1:394*f*
- processing route effects 1:371
- silicon nitride (SiN/Si₃N₄) counterface 1:371, 1:372*f*
- sliding wear comparisons 1:371
- Stellite 6 counterface 1:366
- wear effects 1:366*f*, 1:367*f*, 1:369*f*, 1:370*f*, 1:372*f*
- weight change comparisons 1:380*f*
- niobium (Nb)
 alumina-forming alloys 1:608*t*, 1:609*t*, 1:615*f*
 amorphous alloys 3:2193
 chromia-forming alloys 1:608*t*, 1:609*t*
 chromium–niobium (Cr–Nb) alloys 1:549–550, 1:550*f*, 1:589, 3:2198–2199, 3:2198*f*, 3:2199*f*, 3:2202
 compositions 1:246*t*
 heat-resisting alloys–carburization effects 1:284, 1:284*f*
 intermetallic alloys
 nickel aluminides (NiAl/Ni₃Al) 1:656
 niobium aluminides 1:660
 titanium aluminides (TiAl/Ti₃Al) 1:658
 mechanical properties 3:2137*t*, 3:2137
 nickel-based superalloys 1:693*t*
 stainless steels 3:1811
 Ti18Nb4Sn alloy 2:1314
 Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 titanium niobium (TiNb) alloys 2:1312–1313
 uranium–niobium (U–Nb) alloys 3:2182, 3:2182*t*
- Nitinol 2:764
- nitridation processes 1:304–315
 alumina-forming alloys 1:549, 1:639
 basic concepts 1:260
 computer simulation modelling 1:313, 1:313*f*, 1:314*f*
 corrosion mechanisms 1:262
 environmental conditions 1:400, 1:549
 environment-based alloy selection 1:549, 1:550*f*, 1:551*f*
 equipment concerns 1:260
 general discussion 1:267, 1:314
 heat-resisting alloys
 basic concepts 1:260
 environment-based alloy selection 1:549, 1:550*f*, 1:551*f*
 iron- and nickel-based superalloys 1:310, 1:311*f*
 mechanical/kinetic effects 1:311, 1:312*f*
 protective measures 1:312
 internal nitridation attacks 1:304, 1:305*f*
 laser gas nitriding (LGS) 4:2632
 molybdenum nitride (Mo₃N) 3:2165
 nitridation resistance 1:309*f*
 predictive modeling 1:261*f*, 1:262
 pressure effects 1:263*f*, 1:264*f*, 1:265*f*
 thermochemistry 1:262
 thermodynamics
 diffusion coefficients 1:307*t*
 diffusion-controlled internal nitridation 1:306, 1:306*f*, 1:307*f*, 1:308*f*
 internal–external nitridation transition 1:309, 1:310*f*
 nitrogen-containing gas atmospheres 1:305, 1:305*f*
 solvent surface protrusions 1:307*f*
 stability conditions 1:308, 1:308*f*
 transition stages 1:265*f*
- oxidation processes
 carburization 1:265
 nitridation processes 1:260
 sulfidation/oxidation mechanisms 1:249
- oxide dispersion strengthened (ODS) alloys
 characteristics 1:354
 Incoloy alloys
 characteristics 1:354
 Incoloy 800HT 1:355, 1:364
 load effects 1:358, 1:361*f*, 1:362*f*
 Inconel alloys 1:354
 Nimonic alloys 1:364
- passive alloys
 cathodic modification 3:2224–2249
 active–passive state 3:2227, 3:2228*f*
 active state 3:2227, 3:2228*f*
 background information 3:2226
 basic concepts 3:2227
 chromium alloys 3:2241
 chromium/chromium-based alloys 3:2230
 current research areas 3:2245
 duplex stainless steels 3:2237, 3:2238*t*, 3:2239*f*, 3:2241*t*
 general discussion 3:2225, 3:2247
 iron–40% chromium–platinum–group metals (Fe–40% Cr–PGM) system 3:2243
 noble metal additions 3:2230, 3:2241*t*
 passivation processes 3:2225, 3:2226*f*
 passive film growth and structure analysis 3:2242
 passive state 3:2227, 3:2228*f*
 process mechanisms 3:2229
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 Russian research 3:2242
 schematic diagram 3:2227*f*
 stainless steels 3:2231
 surface alloying processes 3:2239
 transpassive state 3:2228, 3:2228*f*

- alloys (*continued*)
- electroplated coatings 4:259d
 - passivity 2:744
 - platinum-iridium (Pt-Ir) alloys 3:2209
 - platinum-rhodium (Pt-Rh) alloys 3:2209
 - platinum-ruthenium (Pt-Ru) alloys 3:2209
 - rare earth materials 1:246t, 3:2014–2015, 3:2019t
 - reducing environments 1:465, 1:469f
 - rhenium (Re)
 - cobalt-based alloys 3:1918, 3:1918t
 - nickel-based superalloys 1:693t
 - ruthenium (Ru) 1:693t
 - silicon (Si)
 - alumina-forming alloys 1:608t, 1:609t
 - aluminum alloys 3:1981
 - chromia-forming alloys 1:608t, 1:609t
 - chromium-containing alloys 1:584t, 1:589
 - compositions 1:246t
 - heat-resisting alloys—carburization effects 1:283
 - high silicon cast iron 3:1746, 3:1747t, 3:1748t
 - high-silicon-chromium iron (Si–Cr Fe) alloys (HSCl) 4:2784
 - intermetallic alloys 1:658, 1:664
 - iron-silicon (Fe–Si) alloys 4:2783
 - low-alloy steels 1:566
 - magnesium alloys 3:2015, 3:2016t, 3:2019t
 - magnesium-silicon-containing alloys 3:1981
 - silicon-aluminum (Si–Al) alloys 2:1440, 2:1441f
 - silicon bronzes 2:1119f, 3:1943, 3:1952t
 - silicon-molybdenum iron (Si–Mo Fe) alloys 4:2784
 - stainless steels 2:1232–1233, 3:1810
 - silver (Ag)
 - galvanic corrosion 2:831f, 2:836f, 2:851t
 - impressed current anodes 4:2814t, 4:2815
 - lead-silver (Pb–Ag) alloys 3:2055, 3:2055t, 4:2814t, 4:2815
 - silver-copper (Ag–Cu) alloys 1:67f
 - silver-gold (Ag–Au) alloys 2:803f, 2:805f, 2:806f, 2:867t, 3:2215
 - soldering and brazing processes 3:2451t
 - solders 3:2075
 - solid oxide fuel cells (SOFCs) 1:484
 - standard reduction potential 3:2074t
 - Stellite 6 steel
 - corrosion behavior 3:1924, 3:1926f, 3:1927f
 - microstructure 3:1921f
 - normalized alloy content 3:1932, 3:1933t
 - passive film analysis 3:1923, 3:1925f
 - processing techniques 3:1920
 - total weight loss (TWL) tests 3:1930, 3:1933f, 3:1934f
 - wear-corrosion 3:1931, 3:1932f
 - stress growth measurements 1:159t
 - structural metallurgy
 - complex alloy systems 1:75
 - components and phases 1:62
 - dislocation-based segregation 1:63
 - equilibrium phase diagrams
 - binary isomorphous phase diagrams 1:64, 1:64f
 - complex binary phase diagrams 1:66, 1:67f, 1:68f, 1:69f, 1:70f
 - coring 1:65
 - eutectic phase diagrams 1:65, 1:65f, 1:66f
 - general discussion 1:63
 - general discussion 1:61
 - grain boundary-based segregation 1:63
 - intermediate phases/intermetallic compounds 1:63
 - iron-iron carbide (Fe–Fe₃C) phase diagram
 - austenite decomposition 1:66
 - bainite formation 1:70, 1:71f
 - general discussion 1:66
 - hypo-eutectoid steel transformation 1:71, 1:72f
 - iron-rich end 1:69f
 - isothermal transformation diagrams 1:71, 1:71f, 1:72f
 - martensite formation 1:70, 1:71f
 - martensite tempering 1:72, 1:73f
 - pearlite formation 1:69, 1:70f, 1:71f
 - spheroidized structures 1:73
 - limited and complete solid solubility 1:63
 - solid solutions 1:62, 1:62f
 - sulfate-reducing bacteria (SRB)
 - copper/copper alloys 2:1178, 2:1178f
 - copper-nickel alloys 2:1178
 - stainless steels 2:1175, 2:1176, 2:1177f, 2:1178f
 - sulfidation corrosion
 - environment-based alloy selection 1:551–552, 1:552f
 - equipment concerns 1:240
 - general discussion 1:267
 - process mechanisms
 - alloy compositions 1:246t
 - basic concepts 1:240, 1:241f
 - carbon steel 1:241f
 - corrosion rate predictions 1:243, 1:246f, 1:247f, 1:259f
 - high-nickel alloys 1:242, 1:243f, 1:245f
 - hydrogen sulfide (H₂S) 1:241f, 1:242f
 - iron-nickel-sulfur (Fe–Ni–S) alloys 1:244f, 1:245f
 - laboratory simulations 1:245
 - nickel-sulfur (Ni–S) alloys 1:242, 1:243f
 - parabolic rate constant plot 1:256f
 - pressure effects 1:259f, 1:260f
 - steam concentration effects 1:260f
 - sulfidation/oxidation mechanisms 1:249, 1:250f, 1:255f, 1:256f, 1:259f, 1:260f
 - time dependence factors 1:243, 1:248f
 - superalloys 1:692, 1:693f, 1:693t, 3:1918
 - tantalum (Ta)
 - amorphous alloys 3:2193–2194
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1216f, 2:1222, 2:1223f
 - chromium-tantalum (Cr–Ta) alloys 3:2198–2199, 3:2198f, 3:2199f
 - cobalt-based alloys 3:1918, 3:1918t
 - intermetallic alloys 1:656
 - mechanical properties 3:2137t, 3:2137
 - nickel-based superalloys 1:693t
 - process equipment materials 4:3211
 - sulfuric acid (H₂SO₄) environments 2:1246, 2:1246f, 2:1247f
 - Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 - tin (Sn)
 - bearing metals 3:2076
 - lead-tin (Pb–Sn) alloys 3:2055, 3:2055t
 - magnesium-tin (Mg–Sn) alloys 1:67f
 - sacrificial anodes 4:2768–2769
 - solders 3:2075
 - tin interconnections 3:2076
 - titanium (Ti)
 - acid pickling
 - hydrochloric acid (HCl) 4:2992t
 - nitric acid (HNO₃) 4:2993t
 - phosphoric acid (H₃PO₄) 4:2993t
 - sulfuric acid (H₂SO₄) 4:2992t
 - aircraft corrosion 4:3178t
 - corrosion behavior 4:3183
 - design guidelines 4:3191t
 - fretting corrosion 4:3183
 - galvanic corrosion 4:3183
 - industrial applications 3:2048
 - protective treatments 4:3184t, 4:3189, 4:3190f
 - solid-metal embrittlement 4:3183
 - stress corrosion cracking (SCC) 4:3183
 - alkali corrosion 2:1204
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1220, 2:1221f
 - applications
 - aerospace industry 3:2048
 - biomedical devices 3:2049
 - chemical process industry 3:2049
 - dental fixtures 3:2049
 - general discussion 3:2048
 - power generation 3:2049
 - seawater and brine applications 3:2048
 - chromia-forming alloys 1:424f
 - cobalt-based alloys 3:1918t
 - compositions 1:246t
 - corrosion behavior
 - fluorine (F) influences 3:2045
 - general discussion 3:2044
 - hydrogen absorption 3:2046
 - pH factors 3:2045
 - temperature effects 3:2045

- corrosion fatigue 2:948
 crevice corrosion 2:760
 electroplated coatings 4:2578
 erosion resistance 2:985*f*
 ferritic chromium steels 1:501*r*
 general discussion 3:2042
 internal corrosion risks 4:3217*f*
 localized corrosion processes
 crevice corrosion 3:2046
 general discussion 3:2046
 hydrogen-induced cracking (HIC) 3:2047
 stress corrosion cracking (SCC) 3:2047
 marine corrosion 2:1120*f*, 2:1137
 nickel-based superalloys 1:693*r*
 nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
 physical properties 3:2042, 3:2044*r*
 process equipment materials 4:3210*f*, 4:3211
 sacrificial anodes 4:2769
 stainless steels 3:1810
 steam and steam/hydrogen environments 1:452, 1:452*f*, 1:453*f*
 strength comparisons 3:2388*f*
 stress corrosion cracking (SCC) 2:867*r*
 sulfuric acid (H₂SO₄) environments 2:1243, 2:1244*f*
 uranium–titanium (U–Ti) alloys 3:2182, 3:2182*r*
- tungsten (W)
 aluminum–tungsten (Al–W) alloys 3:2194*f*, 3:2195–2196
 amorphous alloys 3:2155, 3:2193–2194, 3:2194*f*
 chemical compositions 1:246*t*, 3:2153*r*
 cobalt-based alloys 3:1918, 3:1918*r*
 cobalt–chromium–tungsten (Co–Cr–W) system 3:1920
 general discussion 3:2153
 intermetallic alloys 1:656, 1:658
 nickel-based superalloys 1:693*r*
- unified numbering system (UNS) 4:3053
 wood corrosivity 2:1326
- zinc (Zn) 3:2078–2093
 cast iron corrosion 3:1774
 copper–zinc (Cu–Zn) alloys 1:68*f*
 corrosion properties
 acid environments 3:2086
 alkaline environments 3:2086
 atmospheric corrosion 3:2081, 3:2082*t*, 3:2083*f*, 3:2083*r*
 bimetallic corrosion 3:2081
 cathodic protection 3:2089
 chemical environments 3:2086
 conductivity water 3:2084*f*
 corrosion rates 3:2081*f*
 corrosion reactions 3:2081*r*
 distilled water 3:2084*t*, 3:2085*f*
 galvanic corrosion 3:2080–2081
 general discussion 3:2080
 hard water 3:2084*f*
 intergranular corrosion 2:820, 3:2091
 natural waters 3:2083
 organic chemicals 3:2089
 pH effects 3:2081*f*, 3:2084–2085
 protective film formation 3:2080
 salt solutions 3:2089
 seawater 2:1142, 3:2085
 soil corrosion 3:2085, 3:2087*r*
 temperature effects 3:2085, 3:2085*f*, 3:2086*f*
 zinc–aluminum (Zn–Al) casting alloy corrosion 3:2090, 3:2091*r*
- electroplated coatings 4:2578
 intergranular corrosion 2:820, 3:2091
- magnesium (Mg) 3:2013
 mechanical properties 3:2079
 physical properties 3:2079
 pitting corrosion potential 2:782*f*
 recent research developments 3:2091
 sacrificial anodes 4:2767–2768, 4:2768*r*
 uniform corrosion 2:730
- Zircaloy 3:2096, 3:2097*t*, 3:2099*t*, 3:2111
- zirconium (Zr)
 alloy categories 3:2096
 alumina-forming alloys 1:608*t*, 1:609*t*, 1:628
 amorphous alloys 3:2194
 anhydrous hydrogen halide gases/hydrohalic acids 2:1216*f*, 2:1221
- chemical properties 3:2100
 chromia-forming alloys 1:608*t*, 1:609*t*
 chromium–zirconium (Cr–Zr) alloys 1:589, 3:2198–2199, 3:2198*f*, 3:2199*f*, 3:2201
- cobalt-based alloys 3:1918*r*
 corrosion resistance 3:2100
- corrosive environments
 acetic acid 3:2125
 alkaline solutions 2:1204, 3:2124
 chlorinated organic compounds 3:2126
 chromic acid 3:2122
 cooling waters 3:2112
 formic acid 3:2125
 halogen acids 3:2116, 3:2130
 hydrogen peroxide (H₂O₂) 3:2124
 inorganic acids 3:2113
 mixed acids 3:2122, 3:2124*r*
 nitric acid (HNO₃) 3:2119, 3:2122*f*, 3:2124*r*, 3:2131
 organic acids 3:2125
 phosphoric acid (H₃PO₄) 3:2121, 3:2123*f*
 pressurized water and steam 3:2112
 salt solutions 3:2113, 3:2113*r*
 sulfur compounds 3:2113
 sulfuric acid (H₂SO₄) 3:2113, 3:2115*f*, 3:2116*f*, 3:2117*f*, 3:2118*f*, 3:2124*r*
 urea 3:2125
- corrosivity
 corrosion rates 3:2128*r*
 crevice corrosion 3:2106
 delayed hydride cracking 3:2109
 erosion 3:2110, 3:2111*f*
 fretting corrosion 3:2110
 galvanic corrosion 3:2109, 3:2110*r*
 intergranular corrosion 3:2107, 3:2108*f*
 localized corrosion 3:2106
 microbially-induced corrosion (MIC) 3:2110
 oxide films 3:2103
 pH effects 3:2105
 pitting corrosion 3:2106, 3:2107*f*
 potential–pH (Pourbaix) diagram 3:2105*f*
 stress corrosion cracking (SCC) 3:2108
 surface conditions 3:2111, 3:2111*f*
 temperature effects 3:2104, 3:2105*f*
 tin additions 3:2111
 water effects 3:2104
 Zircaloy 3:2096, 3:2097*t*, 3:2099*t*, 3:2111
- fatigue limits 3:2099*r*
 ferritic chromium steels 1:501*r*
 future developments 3:2132
- halogen acid corrosion
 anodic polarization curves 3:2120*f*, 3:2121*f*
 characteristics 3:2116
 corrosion rates 3:2124*t*, 3:2128*r*
 electrochemical protection 3:2129*r*
 fluoride-containing solutions 3:2119*r*
 hydrochloric acid (HCl) 3:2120*f*, 3:2121*f*
 industrial environments 3:2130
 isocorrosion diagram 3:2120*f*
- high-temperature environments
 high-temperature oxidation 3:2126
 hot corrosion 3:2126
 molten salts/molten metals 3:2127
- industrial applications
 general discussion 3:2130
 halogen acid-using processes 3:2130
 nitric acid-using processes 3:2131
 sulfuric acid-using processes 3:2130
- intergranular corrosion 2:820
 intermetallic alloys 1:655, 1:659
 internal corrosion risks 4:3217*f*
 magnesium alloys 3:2013, 3:2016*t*, 3:2019*r*
 manufacturing processes
 chemical cleaning 3:2103
 fabrication processes 3:2101
 handling concerns 3:2102
 heat treatments 3:2103
 welds 3:2103

- alloys (*continued*)
- mechanical properties 3:2098*t*
 - microstructure 3:2099, 3:2101*f*, 3:2102*f*
 - nuclear and nonnuclear grades 3:2097*t*
 - process equipment materials 4:3211
 - protective treatments
 - electrochemical protection 3:2128, 3:2128*t*, 3:2129*t*
 - film formation 3:2127
 - heat treatments 3:2128, 3:2129*t*
 - pH adjustments 3:2128, 3:2129*t*
 - surface conditions 3:2111*f*, 3:2128
 - welds 3:2128, 3:2129*t*
 - safety concerns 3:2132
 - stress corrosion cracking (SCC) 2:867*t*
 - stress-strain plots 3:2100*f*
 - sulfuric acid (H₂SO₄) environments 2:1244, 2:1245*f*
 - tensile properties-temperature curves plot 3:2100*f*
 - Ti15Mo5Zr3Al alloy 2:1313
 - zirconium-hafnium (Zr-Hf) alloys 3:2097*t*, 3:2098
- all volatile treatment (oxidizing) (AVT(O)) 4:2978
- all volatile treatment (reducing) (AVT(R)) 4:2977
- alpha(α)-radiation 2:1330
- alternating current (AC) corrosion 4:2833
- background information 4:2833
 - interference effects
 - assessment techniques 4:2836
 - bituminous-coated pipeline 4:2835*f*
 - data results and analysis 4:2837
 - FBE-coated pipeline 4:2836*f*
 - general discussion 4:2834
 - mitigation measures 4:2837, 4:2837*t*
 - PE-coated pipeline 4:2835*f*
 - voltage calculations 4:2835, 4:2836*f*
 - interference sources 4:2833
 - pipeline corrosion management 4:3281, 4:3286
- alternating current (AC) impedance spectroscopy (ACIS) 4:3130
- aluminum (Al)
- above-water fastener selection 2:847*f*
 - adhesive bond failure 3:2471*f*, 3:2475, 3:2477*f*, 3:2478*f*, 3:2479*f*
 - airframe corrosion 4:3177, 4:3178*t*
 - alumina (Al₂O₃)
 - alumina-forming alloys 1:606-645
 - amorphous alloys 3:2197*f*
 - chemically resistant bricks 3:2340, 3:2340*t*
 - comparative attack rates 3:2302*f*
 - corrosion resistance 3:2289, 3:2290*t*
 - corrosion test results 3:2291*t*, 3:2293*f*
 - corundum 1:653, 1:654*f*, 1:674
 - diffusion-controlled internal nitridation 1:307*f*
 - diffusion processes 1:129, 1:137
 - dye penetration 3:2291*f*
 - Ellingham diagram 1:542*f*, 1:652*f*
 - enamel frit compositions 3:2321*t*, 3:2331*t*
 - equilibrium oxygen partial pressure 1:410*f*
 - flexural strength 3:2292*f*
 - fracture toughness values 1:168*t*
 - free energy 1:542*f*
 - glass compositions 3:2308*t*
 - high alumina cement (HAC) 3:2353
 - high-temperature coatings 1:693
 - Kirkendall effect 1:651-653, 1:652*f*
 - metal-matrix composites 3:2251
 - nitridation processes 1:307*f*
 - oxidation processes 1:606-645
 - Auger depth profiles 1:216*f*
 - breakaway oxidation 1:634
 - compositions 1:607, 1:608*t*, 1:609*t*
 - creep rupture life 1:611*f*
 - cross-section image 1:221*f*
 - diffusion rates 1:221, 1:222*f*
 - environmental conditions 1:637
 - general discussion 1:215, 1:640
 - high-temperature oxidation 1:606-645
 - hydrogen permeability 1:612*f*
 - isotope profiles 1:220*f*
 - oxidation rates 1:218, 1:219*f*
 - oxide growth mechanisms 1:219, 1:220*f*
 - reactive elements 1:224
 - scale adhesion 1:223, 1:223*f*
 - scale development 1:216, 1:216*f*
 - scale morphology 1:217*f*, 1:220*f*
 - selective oxidation 1:612
 - spalled oxide mass 1:610*f*, 1:617*f*
 - steady-state oxidation 1:621
 - steam and steam/hydrogen environments 1:449
 - total mass gain 1:607, 1:610*f*, 1:614*f*, 1:617*f*
 - transient oxidation 1:617
 - oxidation tendencies 1:389*f*
 - oxide basicity 1:477*f*
 - oxide scale growth 1:148
 - oxide solubility 1:476-477, 1:476*f*
 - pack aluminizing process 4:2537*t*
 - parabolic rate constant plot 1:146*f*
 - Pilling-Bedworth ratio (PBR) 1:146*t*, 1:160*t*
 - point defects 1:129
 - Poisson ratios 1:170*t*
 - Portland cement 3:2349, 3:2350*t*
 - protective oxidation coatings 1:705, 1:706*f*
 - resistivities 3:2257*t*
 - scale failure strain measurements 1:167*t*
 - silicon nitride (SiN) 3:2300
 - solubility plot 1:320*f*
 - spalling tendencies 1:144, 3:2291*f*
 - stress growth measurements 1:159*t*
 - sulfidation corrosion 1:551-552, 1:552*f*
 - superheater deposit composition 1:464*t*
 - surface fracture energies 1:170*t*
 - thermal expansion coefficients 1:145*f*
 - titanium aluminides (TiAl/Ti₃Al) 1:656, 1:656*f*
- alumina-forming alloys
- oxidation processes
 - Auger depth profiles 1:216*f*
 - cross-section image 1:221*f*
 - diffusion rates 1:221, 1:222*f*
 - general discussion 1:215
 - high-temperature oxidation 1:606-645
 - isotope profiles 1:220*f*
 - oxidation rates 1:218, 1:219*f*
 - oxide growth mechanisms 1:219, 1:220*f*
 - reactive elements 1:224
 - scale adhesion 1:223, 1:223*f*
 - scale development 1:216, 1:216*f*
 - scale morphology 1:217*f*, 1:220*f*
 - steam and steam/hydrogen environments 1:449
- aluminized steel 4:3043, 4:3043*t*, 4:3044*t*
- aluminosilicate ceramics 3:2289, 3:2302*f*
- aluminum alloys 3:1974-2010
- acid pickling
 - hydrochloric acid (HCl) 4:2992*t*
 - phosphoric acid (H₃PO₄) 4:2993*t*
 - sulfuric acid (H₂SO₄) 4:2992*t*
- aircraft corrosion
- airframe corrosion 4:3178*t*
 - corrosion-resistant alloys 4:3184*t*
 - design guidelines 4:3191*t*
 - exfoliation 4:3181*t*
 - materials selection 4:3180
 - plating methods 4:3188*t*
 - protective treatments 4:3184, 4:3185*f*
 - reprotective treatments 4:3194*t*
 - stress corrosion cracking (SCC) 4:3182*t*
 - threshold stresses 4:3181-3182, 4:3182*t*
- alloy designation systems
- cast aluminum alloys 3:1980*t*
 - copper/copper-magnesium-containing alloys 3:1981
 - 8xxx alloys 3:1982
 - general discussion 3:1979
 - lithium-containing alloys 3:1981
 - magnesium-containing alloys 3:1980
 - magnesium-silicon/silicon-containing alloys 3:1981
 - manganese-containing alloys 3:1979
 - pure aluminum 3:1979
 - temper designations 3:1980*t*

- wrought aluminum alloys 3:1980r
zinc/zinc-magnesium-containing alloys 3:1981
- aluminum-copper (Al-Cu) alloys 1:68f
aluminum-lithium (Al-Li) alloys 2:930f
applications 3:2007
atmospheric conditions 2:1086, 2:1087f
automotive industry 4:3170
carburization 1:551, 1:639
cast iron corrosion 3:1773
characteristics
 alloy designation systems 3:1979, 3:1980r
 cast aluminum alloys 3:1980r, 3:1983, 3:1983r
 mechanical properties 3:1977, 3:1983r
 physical properties 3:1982, 3:1982r, 3:1983r
 temper designations 3:1980r
 wrought aluminum alloys 3:1980r, 3:1982, 3:1983r
- cobalt-based alloys 3:1918r
cobalt-chromium-aluminum-yttrium (CoCrAlY) alloys 1:537f, 1:631
cobalt-nickel-chromium-aluminum-yttrium (CoNiCrAlY) alloys 1:537f, 4:2552
- compositions 1:246r, 1:608r, 1:609r
corrosion fatigue 2:947, 2:948f
corrosion prevention strategies
 anodized coatings 3:2005, 3:2006f
 cleaning 3:2003, 4:3319-3320
 conversion coatings 3:2002
 corrosion susceptibility 3:2003, 3:2003f
 grinding effects 3:2004, 3:2005f
 inhibitors 3:2001
 organic coatings 3:2006
 pretreatment options 3:2002
corrosion removal methods 4:3322, 4:3323f
- corrosivity
 acid corrosion 3:1998, 3:1999f
 alkali corrosion 3:1999
 alloy processing influences 3:1996
 atmospheric corrosion 3:1996
 bimetallic corrosion 3:1988
 chemical environments 3:1998
 corrosion potential 3:1988r, 3:1991r
 crevice corrosion 3:1989
 early stage corrosion 3:1991f
 environmentally-assisted cracking 3:1993
 exfoliation 3:1993
 filiform corrosion 2:996f, 2:999, 2:999f, 2:1000f, 3:1990
 forms and causes 3:1986
 galvanic corrosion 3:1988
 general dissolution 3:1986
 high-temperature corrosion 3:2000
 inorganic salts 3:1999
 intergranular corrosion 3:1992, 3:1993f
 intermetallic particles 3:1990, 3:1991r
 marine environments 2:1138
 microstructure effects 3:1990, 3:1991r
 organic compounds 3:2000
 pitting corrosion 3:1986, 3:1988f, 3:1991f
 potential-pH (Pourbaix) diagram 3:1987f
 protective oxidation films 3:1978f, 3:1979f, 3:1986
 soil corrosion 3:1998
 water corrosion 3:1997
- creep rupture life 1:611f
current markets 3:2007
- electroplated coatings 4:2578, 4:2590
- environmentally-assisted cracking
 corrosion fatigue 3:1995, 3:1996f
 hydrogen embrittlement 3:1996
 liquid metal embrittlement (LME) 3:1995, 3:1995f
 stress corrosion cracking (SCC) 3:1993, 3:1994f, 3:1995r
- erosion resistance 2:985f
ferritic chromium steels 1:501r
filiform corrosion 2:996f
functionality 1:609r
galvanic corrosion 2:831f, 2:851r, 2:852r, 2:1119f
general discussion 3:1975
global production 3:1976
high-temperature corrosion
 applied stress conditions 3:2001
 dry atmospheres 3:2000
 high-temperature aqueous systems 3:2000
 molten salts and metals 3:2000
 nonmetal material contact 3:2000
- historical background 3:1975
hydrogen permeability 1:612f
intergranular corrosion 2:814, 2:821r
iron-aluminum (Fe-Al) alloys 1:292, 1:452, 1:613f, 1:636f
iron-chromium-aluminum (Fe-Cr-Al) alloys
 alloy grain size effects 1:616f
 base metal oxide formation 1:619f
 cubic alumina phases 1:620f, 1:621f
 cycle frequency effects 1:632, 1:632f, 1:633f
 internal oxidation 1:633, 1:634f
 metal dusting 1:292
 nitridation processes 1:639
 parabolic rate constants 1:622r, 1:624r
 reactive element additions 1:227r
 scale adhesion 1:628f
 scale growth rate 1:546f, 1:621, 1:622f, 1:623f
 scale morphology 1:626, 1:627f
 specimen mass gain 1:623f
 sulfidation 1:552f, 1:638
 sulfur impurities 1:230, 1:231f
 water vapor effects 1:637
- laser cladding (LC) 4:2624, 4:2633r
laser gas nitriding (LGS) 4:2632, 4:2632f
- low-alloy steels 1:566
- magnesium (Mg) 3:2013, 3:2016r, 3:2019f, 3:2019r
- marine environments
 corrosion rates 2:1139r
 maximum depth of attack 2:1140r
 pit depth measurements 2:1140f
 wrought aluminum alloy designations 2:1139r
- metal dusting 1:292
- microscopy-based analytical techniques
 aluminum-copper (Al-Cu) alloy oxide film 2:1410-1411, 2:1412f
 electron backscatter diffraction (EBSD) 2:1413f
 electron diffraction 2:1417, 2:1417f
 electron energy loss spectroscopy (EELS) 2:1421, 2:1423f
 electron probe microanalysis (EPMA) 2:1420, 2:1422f
 heat-affected zone (HAZ) 2:1406f
 high-resolution transmission electron microscopy (HRTEM) 2:1415, 2:1416f
 scanning electron microscopy (SEM) 2:1410f, 2:1411f, 2:1415f
 specimen preparation techniques 2:1424, 2:1425f
 transmission electron microscopy (TEM) 2:1414f, 2:1415f, 2:1425f
 X-ray analysis 2:1418, 2:1419f, 2:1420f
- nickel-chromium-aluminum (Ni-Cr-Al) alloys
 base metal oxide formation 1:617, 1:618f, 1:619f
 compositions 1:609r, 1:693r
 depletion profiles 1:695f
 diffusion-controlled internal nitridation 1:307f
 high-temperature oxidation 1:613, 1:614f, 1:692, 1:693f
 nitridation processes 1:639
 oxide map 1:614f
 platinum-group metal effects 1:616
 specimen mass gain 1:619f
 thermodynamic stability 1:308, 1:308f
- nickel-chromium-aluminum-yttrium (NiCrAlY) alloys 1:615-616, 1:632f, 1:639
- nickel-cobalt-aluminum-yttrium (NiCoAlY) alloys 4:2624-2625
- oxidation processes 1:606-645
 Auger depth profiles 1:216f
 breakaway oxidation 1:634
 compositions 1:607
 cross-section image 1:221f
 diffusion rates 1:221, 1:222f
 environmental conditions 1:637
 general discussion 1:215, 1:640
 isotope profiles 1:220f
 oxidation rates 1:218, 1:219f
 oxide growth mechanisms 1:219, 1:220f
 reactive elements 1:224
 scale adhesion 1:223, 1:223f
 scale development 1:216, 1:216f
 scale morphology 1:217f, 1:220f

- aluminum (Al) (*continued*)
- selective oxidation 1:612
 - steady-state oxidation 1:621
 - transient oxidation 1:617
 - pitting corrosion
 - cathodic polarization curves 2:795*f*
 - intergranular corrosion 2:795, 2:796*t*
 - marine environments 2:1138
 - pitting potentials 2:782*f*, 2:795, 2:796*t*
 - process equipment materials 4:3210*f*, 4:3211
 - processing techniques
 - continuous casting 3:1985
 - direct chill casting 3:1984
 - extrusion 3:1985
 - hot and cold rolling 3:1985
 - shape casting 3:1983
 - relative humidity threshold values 4:3315
 - sacrificial anodes 4:2767–2768, 4:2768*t*, 4:2772
 - silicon–aluminum (Si–Al) alloys 2:1440, 2:1441*f*
 - spalled oxide mass 1:610*f*, 1:617*f*
 - stainless steels 3:1811
 - strength comparisons 3:2388*f*
 - stress corrosion cracking (SCC) 2:867*t*, 3:1993, 3:1994*f*, 3:1995*t*
 - stress growth measurements 1:159*t*
 - sulfidation corrosion 1:551–552, 1:552*f*
 - sulfuric acid (H₂SO₄) environments 2:1242, 3:1999*f*
 - titanium–aluminum (Ti–Al) alloys 1:697
 - total mass gain 1:607, 1:610*f*, 1:614*f*, 1:617*f*
 - welding processes 3:2461
 - wrought aluminum alloy designations 2:1139*t*
- aluminum bronzes
- braced joints 3:2452
 - characteristics 3:1943, 3:1952*t*
 - flow-induced corrosion 2:982*f*
 - galvanic corrosion 2:831*f*, 2:852*t*, 2:853*t*, 2:854*t*, 2:1119*f*, 3:1845*f*
- aluminum carbide (Al₄C₃) 1:275*t*, 3:2263
- aluminum chloride (AlCl₃) 2:1086–1087, 3:1769*t*
- aluminum citrate 3:1769*t*
- aluminum fluoride (AlF₃) 3:1907, 4:2537*t*
- aluminum nitride (AlN) 3:2301
- nitridation processes
- computer simulation modelling 1:314*f*
 - diffusion-controlled internal nitridation 1:306, 1:307*f*
 - general discussion 1:314
 - heat-resisting alloys 1:260
 - iron- and nickel-based superalloys 1:310, 1:311*f*
 - laser gas nitriding (LGS) 4:2632–2633
 - mechanical/kinetic effects 1:311, 1:312*f*
 - thermodynamic stability 1:308, 1:308*f*
 - thermal expansion coefficients 1:145*f*
- aluminum sulfate (Al₂SO₄) 2:1086–1087, 3:1769*t*
- aluminum thiocyanate 3:1769*t*
- aluminum–tungsten (Al–W) alloys 3:2194*f*, 3:2195–2196
- amorphous alloys 3:2193–2194, 3:2194*f*, 3:2195–2196, 3:2197*f*, 3:2201, 3:2201*f*
- atmospheric corrosion 2:848*f*
- atomic force microscopy (AFM) 2:1440, 2:1441*f*
- below-water fastener selection 2:849*f*
- cast iron corrosion 3:1773
- cathodic protection 4:2755, 4:2755*t*
- chromium–aluminum (Cr–Al) alloys 3:2198*f*
- coatings
- aircraft corrosion 4:3184, 4:3186*f*
 - aluminide coatings 1:537*f*, 4:2543
 - aluminum pigmented coatings 4:2694*t*
 - characteristics 2:1165, 4:2525
 - corrosion-resistant coatings 4:2618, 4:3184*t*
 - diffusion coatings 4:2535*t*, 4:2536*t*
 - failures and defects 4:2731
 - flame sprayed coatings 4:2613, 4:2780
 - hot-dipped coatings
 - basic concepts 4:2556
 - corrosion behavior 4:2564
 - hot dip aluminization 4:2572
 - metal–chromium–aluminum–yttrium (MCrAlY) coatings
 - aluminum depletion 1:709
 - characteristics 1:696, 4:2550
 - compositions 1:696*t*
 - cracking 1:706, 1:707*f*, 1:708*f*
 - estimated effective fracture energies 1:709*t*
 - finite-element modeling predictions 1:708, 1:708*f*
 - gas turbines 1:537*f*
 - microstructure 1:697*f*
 - protective oxidation 1:705, 1:706*f*
 - spalling tendencies 1:706, 1:707*f*, 1:708*f*, 1:709*t*
 - steam and steam/hydrogen environments 1:449, 1:450*f*, 1:451*f*, 1:452*f*
 - structure 1:697*f*
 - titanium–aluminum (Ti–Al) alloys 1:697
 - cobalt-based alloys 3:1918*t*
 - cobalt–chromium–aluminum–yttrium (CoCrAlY) alloys 1:537*f*, 1:631
 - cobalt–nickel–chromium–aluminum–yttrium (CoNiCrAlY) alloys 1:537*f*, 4:2552
 - cordierite (Al₃Mg₂(Si₂AlO₁₈)) 1:674
 - corrosion vulnerability data 4:2956*t*
 - corrosive environments 1:405
 - crystal structure 1:55*t*
 - electrochemical scanning tunnel microscopy (ECSTM) 2:1436
 - Ellingham diagram 1:652*f*
 - exchange current density 3:2217*t*
 - galvanic corrosion 2:850*t*, 2:852*t*
 - galvanizing zinc melts 4:2570
 - general discussion 3:1975
 - heat-resisting alloys–carburization effects 1:284, 1:285*f*
 - high-temperature oxidation 1:183*f*
 - historical background 3:1975
 - intermetallic alloys 1:646–667
 - aluminide coatings
 - alloyed aluminide coatings 1:663, 1:664*f*, 1:665*f*
 - different base–different substrate 1:665, 1:665*f*
 - gas turbines 1:537*f*
 - high-temperature coatings 1:701, 1:701*f*
 - same base–same substrate 1:663
 - simple aluminide coatings 1:663
 - uranium alloys 3:2188
 - applications 1:646
 - coatings
 - aluminide coatings 1:537*f*, 1:663, 1:701, 1:701*f*
 - general discussion 1:662
 - laser cladding (LC) 4:2624, 4:2633*t*
 - platinum aluminides 4:2544, 4:2545*f*, 4:2546*f*, 4:2547*f*, 4:2549*f*
 - common intermetallic alloys
 - crystal structure 1:648*f*
 - general discussion 1:646
 - iron aluminides (FeAl/Fe₃Al) 1:292, 1:609*t*, 1:648, 1:648*f*, 1:650, 1:650*f*
 - nickel aluminides (NiAl/Ni₃Al) 1:547*f*, 1:609*t*, 1:623*f*, 1:646, 1:648*f*, 1:649*f*, 1:650, 1:652*f*, 1:654*f*
 - titanium aluminides (TiAl/Ti₃Al) 1:145*f*, 1:648*f*, 1:649, 1:651*f*
 - general discussion 1:646, 1:666
 - hot corrosion
 - alumina-forming alloys 1:638
 - chlorine-containing environments 1:661, 1:662*f*
 - general discussion 1:660
 - sulfur-containing environments 1:660
 - oxidation processes
 - Ellingham diagram 1:652*f*
 - general discussion 1:649
 - iron aluminides (FeAl/Fe₃Al) 1:650
 - nickel aluminides (NiAl/Ni₃Al) 1:547*f*, 1:623*f*, 1:650, 1:652*f*, 1:654*f*
 - platinum aluminides 1:659
 - titanium aluminides (TiAl/Ti₃Al) 1:656
 - ionizing radiation effects 2:1331
 - iron aluminides (FeAl/Fe₃Al)
 - alumina scale formation 1:654
 - characteristics 1:648
 - chlorine-containing environments 1:661
 - compositions 1:609*t*
 - crystal structure 1:648*f*
 - metal dusting 1:292
 - microstructure 1:651
 - partial pressure effects 1:654
 - phase diagram 1:650*f*
 - porosity 1:651

- reactive element additions 1:227*t*, 1:655
 scale adhesion 1:223
 scale properties 1:650
 sulfur-containing environments 1:660
 sulfur impurities 1:230, 1:231*f*, 1:654–655
 water vapor effects 1:654
 iron aluminum beryllide (FeAlBe₄) 3:2173, 3:2173*f*
 laser cladding (LC) 4:2624, 4:2633*t*
 magnesium alloys 3:2013, 3:2016*t*, 3:2019*f*, 3:2019*t*
 metallurgical properties 3:2169*t*
 Nd:YAG (neodymium-doped yttrium aluminum garnet) laser 3:2024, 4:2623
 nickel aluminate (NiAl₂O₄) 1:182*t*
 nickel aluminides (NiAl/Ni₃Al)
 alumina scale formation 1:547*f*, 1:623*f*, 1:652*f*, 1:654*f*
 aluminide coatings 1:665, 1:665*f*, 3:2188
 characteristics 1:646
 chlorine-containing environments 1:661
 coefficients of thermal expansion (CTEs) 1:632*f*
 compositions 1:609*t*
 crystal structure 1:104, 1:648*f*
 dislocations 1:106–107
 internal oxidation 1:633
 microstructure 1:651
 outward grown diffusion coatings 4:2538, 4:2539*f*
 pack aluminizing process 4:2534, 4:2537*f*, 4:2538*f*
 parabolic rate constants 1:624*t*
 partial pressure effects 1:654
 phase diagram 1:649*f*, 4:2539*f*
 platinum aluminide coatings 4:2544, 4:2545*f*
 porosity 1:651
 reactive element additions 1:227*t*, 1:655
 reactive element-modified aluminides 4:2549
 scale adhesion 1:223
 scale properties 1:650
 sulfur-containing environments 1:660
 sulfur impurities 1:230, 1:231*f*, 1:654–655
 thermal expansion coefficients 1:145*f*
 water vapor effects 1:637, 1:638*f*, 1:654
 nickel–chromium–aluminum (Ni–Cr–Al) alloys
 base metal oxide formation 1:617, 1:618*f*, 1:619*f*
 compositions 1:609*t*, 1:693*t*
 depletion profiles 1:695*f*
 diffusion-controlled internal nitridation 1:307*f*
 high-temperature oxidation 1:613, 1:614*f*, 1:692, 1:693*f*
 nitridation processes 1:639
 oxide map 1:614*f*
 platinum-group metal effects 1:616
 specimen mass gain 1:619*f*
 thermodynamic stability 1:308, 1:308*f*
 nickel–cobalt–aluminum–yttrium (NiCoAlY) alloys 4:2624–2625
 nitric acid (HNO₃)
 containment materials 2:1255
 corrosion rates 2:1255*f*
 corrosion reactions 2:1252*t*
 nitridation processes 1:400, 1:549, 1:639
 pack aluminizing process 4:2534, 4:2537*f*, 4:2537*t*, 4:2538*f*
 pitting corrosion 2:774*t*, 2:779*f*
 potassium aluminum sulfate (KAl(SO₄)₂·12H₂O) 3:1769*t*
 potential–pH (Pourbaix) diagram 1:31, 1:32*f*, 2:1192*f*
 reactive metal pigments 4:2653
 redox couples equilibrium potential values 1:26*t*
 sacrificial anodes 4:2772, 4:2773
 silicon–aluminum (Si–Al) alloys 2:1440, 2:1441*f*
 stainless steels 3:1811
 standard reduction potential 3:2074*t*
 surgical implants
 health effects 2:1310, 2:1310*t*
 historical background 2:1308
 tetracalcium aluminoferrite (C₄AF) 3:2350*t*, 3:2351
 Ti15Mo5Zr3Al alloy 2:1313
 Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 Ti6Al4V alloy
 coatings
 laser cladding (LC) 4:2625
 laser gas nitriding (LGS) 4:2632, 4:2632*f*
 laser-hybrid sprayed coating techniques 4:2627
 laser melt/particle injection (LMI) 4:2628
 corrosion fatigue 2:949, 2:1318, 3:2049
 corrosion resistance 2:764, 2:1313
 crevice corrosion 2:1317
 fretting corrosion 2:1318–1319
 galvanic corrosion 2:1319, 3:2278
 historical background 2:1310
 strength comparisons 3:2388*f*
 zirconium (Zr)-based bulk metallic glasses 3:2200
 titanium aluminides (TiAl/Ti₃Al)
 alloyed aluminide coatings 1:665, 1:697
 characteristics 1:649
 chlorine-containing environments 1:661, 1:662*f*
 crystal structure 1:648*f*
 different base–different substrate coatings 1:665
 high-temperature tribocorrosion
 titanium–aluminum (Ti–Al)–ceramic counterfaces 1:362, 1:365*f*
 titanium–aluminum (Ti–Al)–metallic counterfaces 1:360, 1:363*f*, 1:364*f*
 oxidation processes
 general discussion 1:656
 microstructure 1:657–658
 nitrogen influences 1:657
 pretreatment options 1:658
 reactive element additions 1:658, 1:659*f*
 scale properties 1:656, 1:656*f*
 steam and steam/hydrogen environments 1:452, 1:452*f*, 1:453*f*
 water vapor effects 1:658
 phase diagram 1:651*f*
 sulfur-containing environments 1:660, 1:661*f*
 thermal expansion coefficients 1:145*f*
 uranium alloys 3:2188
 tricalcium aluminate (C₃A) 3:2350*t*, 3:2351
 water chemistry 2:1098*t*
 wood corrosivity 2:1326
 zinc–aluminum (Zn–Al) alloy coatings 4:2557*f*, 4:2558, 4:2558*f*
 zirconium (Zr)-based bulk metallic glasses 3:2199
 Alzheimer's disease 2:1310
 amalgams
 corrosion resistance 2:1316
 crevice corrosion 2:766
 health effects 2:1310
 American Iron and Steel Institute (AISI) 4:3053
 American Society for Testing and Materials (ASTM) 4:3053
 American Water Works Association (AWWA) 2:1162
 amines 3:2000, 4:2490, 4:2992*t*, 4:3217*f*
 amino acids 4:2490
 amino plastics 3:2384
 ammeters 4:2841, 4:2842*f*
 ammonia (NH₃)
 aluminum coatings 4:2564*f*
 ammonia–nitric acid–sulfuric acid–water (NH₃–HNO₃–H₂SO₄–H₂O) systems 2:1058
 ammonia–nitric acid–water (NH₃–HNO₃–H₂O) systems 2:1058
 ammonium bisulfide (NH₄HS) 4:3221–3223
 ammonium chloride (NH₄Cl) 3:1769*t*, 4:2537*t*
 ammonium nitrate (NH₄NO₃) 3:1769*t*, 4:2883
 anodic protection
 ammonium nitrate (NH₄NO₃) 4:2883
 aqueous ammonia solutions 4:2884
 reference electrodes 4:2874*t*
 atmospheric gases 2:1053*t*, 2:1054
 coal plant ammonia absorber system 4:3140, 4:3141*f*
 combustion conditions 1:461*f*
 dry deposition rates 2:1073*t*
 environmental conditions 2:1082*t*
 flue gas composition 1:462*t*
 glass linings and coatings 3:2324*t*
 Henry's law coefficients for common gases 2:1056, 2:1056*t*
 nitridation processes 1:400
 process equipment risk management 4:3217*f*, 4:3219, 4:3220*f*, 4:3220*t*
 rain chemistry 2:1063*f*, 2:1064*t*
 steam boiler systems 4:2977, 4:2986
 sulfuric acid–ammonia–water (H₂SO₄–NH₃–H₂O) systems 2:1057, 2:1058*f*
 tin corrosivity 3:2073

- ammonia (NH₃) (*continued*)
 water chemistry 2:1096, 2:1098*t*
- amorphous alloys 3:2192–2204
 alloying element influences
 corrosion rates 3:2199*f*
 current density dissolution 3:2198*f*
 molybdenum (Mo) 3:2198
 phosphorus (P) 3:2196, 3:2198*f*
 sputter-deposited alloy structures 3:2198*f*
 anodic dissolution rates 3:2195, 3:2195*f*
 background information 3:2192
 bulk metallic glasses
 corrosion behavior 3:2199
 corrosion-resistant bulk metallic glasses 3:2200
 zirconium (Zr)-based bulk metallic glasses 3:2199
 enriched alloy layers 3:2196*f*, 3:2197*f*
 extremely high corrosion resistance mechanisms 3:2194
 hydrochloric acid (HCl) solution testing 3:2193, 3:2193*f*
 iron–chromium (Fe–Cr) alloys 3:2194–2195, 3:2195*t*
 material types 3:2193
 nanocrystalline alloys
 conventional corrosion-resistant materials 3:2202
 corrosion behavior 3:2201
 pitting potential 3:2201*f*
 precipitated materials 3:2201
 repassivation potential 3:2201*f*
 passive films 2:727, 3:2194–2195, 3:2195*t*, 3:2196*f*
 pitting corrosion 3:2193–2194, 3:2194*f*
- amorphous thermoplastics
 acrylonitrile–styrene–butadiene polymers (ABS) 3:2382
 cellulose-based plastics 3:2383
 physical behavior 3:2373
 plasticized amorphous thermoplastics 3:2374
 polymethyl methacrylate (PMMA) 3:2379*t*, 3:2382
 polystyrene 3:2382
 polyvinyl acetate 3:2379*t*, 3:2382
 polyvinyl chloride (PVC) 3:2382
 rubber-modified amorphous plastics 3:2374
 temperature–molecular weight phase diagram 3:2373*f*
- anaemia 2:1310
 anaerobic microorganisms 2:1172, 2:1173*f*
 analog signals 2:1345
 analytical methods
 differential scanning calorimetry (DSC) 3:2393
 dynamic mechanical analysis (DMA) 3:2393
 Fourier transform infrared (FTIR) spectroscopy 3:2393
 gas chromatography (GC) 3:2393
 general discussion 2:1403
 infrared spectroscopy
 attenuated total reflection spectroscopy
 basic concepts 2:1402
 characteristics 2:1376*t*
 basic concepts 2:1402, 2:1426
 characteristics 2:1376*t*
 IR reflection absorption spectroscopy (IRRAS)
 basic concepts 2:1403
 characteristics 2:1376*t*
 tin analyses 3:2071
- ion spectrometry
 general discussion 2:1385
 ion scattering spectrometry (ISS)
 basic concepts 2:1385
 characteristics 2:1376*t*
 depth profile 2:1385*f*
 ultrahigh vacuum (UHV) conditions 2:1376
 Rutherford back scattering (RBS) spectrometry
 basic concepts 2:1386
 characteristics 2:1376*t*
 spectral data plot 2:1386*f*
 ultrahigh vacuum (UHV) conditions 2:1376
 secondary ion mass spectrometry (SIMS)
 basic concepts 2:1387
 characteristics 2:1376*t*
 corrosion product characterizations 1:140, 1:142*f*
 ultrahigh vacuum (UHV) conditions 2:1376
 mass spectrometry (MS) 3:2393
- microscopy
 atomic force microscopy (AFM)
 background information 2:1439
 general discussion 2:1441
 implementation processes 2:1440
 limitations 2:1440
 operating principles 2:1439, 2:1439*f*
 solid/liquid interface applications 2:1440, 2:1441*f*
 electrochemical scanning tunnel microscopy (ECSTM)
 background information 2:1433
 electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*
 implementation processes 2:1433, 2:1434*f*
 limitations 2:1433
 solid/liquid interface applications 2:1434, 2:1435*f*
 scanning probe microscopy 2:1430–1442
 atomic force microscopy (AFM) 2:1439, 2:1439*f*
 background information 2:1431
 electrochemical scanning tunnel microscopy (ECSTM) 2:1433
 scanning tunnel microscopy (STM) 1:379, 2:1431
 scanning tunnel microscopy (STM)
 background information 2:1431
 general discussion 2:1441
 limitations 2:1432
 operating principles 2:1431, 2:1432*f*
 scanning tunnel spectroscopy (STS) 1:379, 2:1432
 solid/gas interface applications 2:1432
 spectroscopy 2:1374–1404
 Auger electron spectroscopy (AES)
 basic concepts 2:1384
 energy diagram 2:1384*f*
 basic concepts 2:1375
 characteristics 2:1376*t*
 electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*
 Fourier transform infrared (FTIR) spectroscopy 3:2393
 general discussion 2:1403
 glow discharge optical emission spectroscopy (GDOES)
 basic concepts 2:1398
 characteristics 2:1376*t*
 depth profile 2:1401*f*
 schematic diagram 2:1399*f*
 infrared spectroscopy 2:1402
 scanning tunnel spectroscopy (STS) 2:1432
 surface analytical methods 2:1375, 2:1376*t*
 ultrahigh vacuum (UHV) conditions 2:1376, 2:1377*f*
 ultraviolet photoelectron spectroscopy (UPS)
 basic concepts 2:1382
 energy diagram 2:1383*f*, 2:1384*f*
 X-ray absorption (XAS)
 basic concepts 2:1395, 2:1395*f*
 characteristics 2:1376*t*
 extended X-ray absorption fine structure (EXAFS) 2:1397–1398, 2:1398*f*
 near edge X-ray absorption fine structure (NEXAFS) spectroscopy 2:1396–1397
 X-ray absorption near edge structure (XANES) 2:1396–1397, 2:1397*f*
 X-ray photoelectron spectroscopy (XPS)
 angular resolved XPS (ARXPS) measurements 2:1380–1382, 2:1381*f*
 Auger energy yield 2:1380*f*
 basic concepts 2:1378
 energy diagram 2:1379*f*
 iron oxidation film evaluations 2:1380–1382, 2:1381*f*, 2:1382*f*
 passive film analysis 2:1380–1382, 2:1381*f*, 2:1382*f*
 schematic diagram 2:1378*f*
 ultrahigh vacuum (UHV) conditions 2:1377*f*
 X-ray reflectivity (XRR)
 basic concepts 2:1393
 characteristics 2:1376*t*
 penetration depth plot 2:1393*f*
 specular X-ray reflectivity profiles 2:1394*f*
 thermogravimetric analysis (TGA) 3:2393
 thermomechanical analysis (TMA) 3:2393
- X-rays
 basic concepts
 brilliance measurements 2:1388*f*
 cell geometries schematic diagram 2:1389*f*
 synchrotron radiation 2:1388, 2:1388*f*
 general discussion 2:1403
 X-ray absorption (XAS)

- basic concepts 2:1395, 2:1395f
 characteristics 2:1376r
 extended X-ray absorption fine structure (EXAFS) 2:1397–1398, 2:1398f
 near edge X-ray absorption fine structure (NEXAFS) spectroscopy 2:1396–1397
 X-ray absorption near edge structure (XANES) 2:1396–1397, 2:1397f
 X-ray diffraction (XRD)
 basic concepts 2:1390, 2:1390f
 cementite analysis 1:286
 characteristics 2:1376r
 corrosion product characterizations 1:140, 1:143f
 passive film structure analysis 2:746, 2:1392f
 scattering geometry schematic diagram 2:1391f
 thermally induced scale changes 1:162–163, 1:163f
 X-ray reflectivity (XRR)
 basic concepts 2:1393
 characteristics 2:1376r
 penetration depth plot 2:1393f
 specular X-ray reflectivity profiles 2:1394f
 anhydrite (CaSO₄) 4:2938, 4:2942r
Anobium punctatum 3:2445
 anodic oxide films 4:2503–2518
 aircraft corrosion 4:3184r
 anodizing procedures 4:2504, 4:2504r
 color anodizing processes 4:2505, 4:2505r
 corrosion resistance
 atmospheric exposure 4:2513r, 4:2516
 general discussion 4:2516
 maintenance factors 4:2513
 research developments 4:2516
 magnesium alloys 3:2034, 3:2035f, 3:2035r, 3:2036f
 porous oxide formation mechanisms
 cross-section diagram 4:2507f
 general discussion 4:2505
 pore quantity 4:2506r
 research developments 4:2515–2516
 TEM cross-section image 4:2507f, 4:2510f, 4:2516f
 unit barrier-layer thickness 4:2506r
 properties
 breakdown voltage 4:2509
 composition 4:2507
 density 4:2508, 4:2508f
 dielectric constant 4:2509
 effect on mechanical properties 4:2514
 emissivity 4:2510r, 4:2511
 flexibility 4:2508
 friction 4:2514
 hardness 4:2508
 heat conduction 4:2510
 heat reflectivity 4:2509f, 4:2511
 heat resistance 4:2511
 reflectivity 4:2511r, 4:2513
 refractive index 4:2513
 research developments 4:2516
 resistance 4:2509
 thermal expansion 4:2510
 thickness measurements 4:2511r, 4:2515
 research developments
 anodizing procedures 4:2514–2515
 color anodizing processes 4:2514
 corrosion resistance 4:2516
 porous oxide formation mechanisms 4:2515–2516
 properties 4:2516
 anodic protection 4:2857–2889
 background information 4:2858
 beryllium (Be) corrosion 3:2174
 components
 cathodes 4:2871, 4:2872f
 electric equipment 4:2874
 reference electrodes 4:2872, 4:2873f, 4:2874r
 schematic diagram 4:2871f
 corrosivity
 erosion 4:2864
 intragranular corrosion 4:2863
 pitting corrosion 4:2863
 stress corrosion cracking (SCC) 4:2864
 electroplated coatings 4:2586, 4:2587f, 4:2588r
 environmental conditions
 aqueous ammonia solutions 4:2884
 carbon steel–sulfuric acid (H₂SO₄) interactions
 corrosion rates 4:2876, 4:2878f
 passivation current density 4:2876f, 4:2877f
 passive range 4:2877f
 potentiodynamic curves 4:2876f
 electroless nickel plating baths 4:2886, 4:2887
 electrolyte conductivity 4:2875, 4:2875f
 hydrochloric acid (HCl) 4:2882, 4:2883f
 inorganic salts
 ammonium nitrate (NH₄NO₃) 4:2883
 chloride compounds 4:2883
 phosphate compounds 4:2883
 sulfate compounds 4:2883
 thiocyanate compounds 4:2883
 melts 4:2885
 organic acids 4:2882
 phosphoric acid (H₃PO₄) 4:2881, 4:2882f
 sodium hydroxide (NaOH)
 corrosion rates 4:2884, 4:2885f
 potentiodynamic curves 4:2885f
 reference electrodes 4:2874r
 storage tanks 4:2888
 stainless steels–sulfuric acid (H₂SO₄) interactions
 corrosion rates 4:2878, 4:2879f
 passivation current density 4:2879f
 passive range 4:2879f
 sulfuric acid (H₂SO₄)
 carbon steel 4:2876
 cast iron 4:2876
 specific conductivity 4:2876
 stainless steels 4:2878, 4:2879f
 titanium (Ti) 4:2880, 4:2881f
 titanium–sulfuric acid (H₂SO₄) interactions
 corrosion rates 4:2880, 4:2881f
 passivation current density 4:2881f
 industrial applications
 carbon steel
 alkaline environments 4:2888
 cellulose boilers 4:2888
 liquid fertilizer storage tanks 4:2888
 sulfuric acid (H₂SO₄) 4:2887
 cellulose boilers 4:2888
 liquid fertilizer storage tanks 4:2888
 molybdenum heating electrodes 4:2888
 stainless steel vessels
 electroless nickel plating baths 4:2887
 phosphoric acid (H₃PO₄) 4:2887
 sulfuric acid (H₂SO₄) 4:2886, 4:2887, 4:2887f, 4:2888f
 titanium exchangers 4:2888
 operation modes
 emergency modes 4:2869, 4:2870f
 general discussion 4:2867
 polarization conditions
 constant terminal voltage polarization 4:2869
 periodic polarization 4:2869
 potentiostatic polarization 4:2868
 protectors 4:2871
 start-up modes 4:2868
 passive metals
 basic concepts 4:2860
 passivation potential 4:2860f
 polarization curve potential–current density plot 4:2860f, 4:2862f
 protected objects
 basic requirements 4:2865
 heat transfer conditions 4:2867
 level influences 4:2866
 object types 4:2865
 throwing power 4:2866
 anthracite coal 1:459r
 anthraquinone 2:1326
 antichip coatings 4:3173
 anticorrosive waxes 4:3173
 antifouling coatings 2:1143, 4:2691, 4:2692r, 4:2949
 antimony (Sb)

- antimony (Sb) (*continued*)
 antimony oxide (Sb_2O_3) 3:2197*f*, 3:2331*t*
 corrosion-resistant coatings 4:2995
 lead-antimony (Pb-Sb) alloys 1:65*f*, 1:66*f*, 3:2055, 3:2055*t*
 magnesium alloys 3:2019*t*
- antioxidants 2:1303*t*
- antiozonant mechanisms 3:2433
- antiwear compounds 2:1302, 2:1303*t*
- API 580/API 581 4:3238–3239, 4:3016, 4:3016*f*, 4:3017*f*, 4:3091
- aqueous corrosive environments 3:1879–1915
 age-hardenable nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
 alloy 28
 corrosion loss measurements 3:1894*t*, 3:1895*t*, 3:1896*t*, 3:1897*t*
 phosphoric acid (H_3PO_4) production 3:1905
 pitting potential 3:1895*f*
 alloy 200 3:1902, 3:1908
 alloy 201 3:1902, 3:1902*f*
 alloy 316 3:1897*t*
 alloy 39 3:1911*f*
 alloy 400 3:1907, 3:1908, 3:1909
 alloy 600 3:1902, 3:1908
 alloy 617 3:1908
 alloy 690 3:1896*t*
 alloy 800 3:1908
 alloy 904L 3:1897*t*, 3:1906*f*
 alloy 926
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 hydrofluoric acid (HF) production 3:1907
 phosphoric acid (H_3PO_4) production 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*
 pollution controls 3:1914
 stability limits 3:1895*f*
 styrene production 3:1908
 vinyl chloride monomer (VCM) production 3:1908
- alloy B-2 3:1903, 3:1907, 3:1908, 3:1909, 3:1911*f*
- aqueous carbon dioxide (CO_2) corrosion
 mild steel
 carbon dioxide (CO_2) partial pressure effects 2:1281, 2:1282*f*, 2:1283*f*
 carbonic acid (H_2CO_3) reduction reactions 2:1278
 carbonic species concentrations 2:1275*f*
 characteristics 2:1273
 condensation effects 2:1285
 corrosion inhibitors 2:1284
 corrosion rate calculations 2:1280
 crude oil effects 2:1285
 electrochemical reactions 2:1277
 equilibrium relations 2:1273, 2:1274*f*, 2:1275*f*
 flow effects 2:1283, 2:1284*f*
 glycol/methanol effects 2:1285
 hydronium (H^+) ion reduction reactions 2:1278
 influencing factors 2:1281
 iron carbonate (FeCO_3) 2:1275*f*, 2:1276*f*, 2:1290*f*
 localized corrosion 2:1286
 mixed hydrogen sulfide–carbon dioxide (H_2S – CO_2) saturated
 aqueous solutions 2:1289, 2:1292
 modeling approaches 2:1280, 2:1281*f*
 nonideal solutions/gases 2:1286
 organic acid effects 2:1285
 oxidation reactions 2:1278
 pH effects 2:1274*f*, 2:1281, 2:1282*f*
 solubility calculations 2:1287*f*
 temperature effects 2:1282, 2:1283*f*
 transport processes 2:1279
 water (H_2O) reduction reactions 2:1279
- aqueous hydrogen sulfide (H_2S) corrosion
 mild steel
 characteristics 2:1286
 corrosion rate calculations 2:1291, 2:1294*f*, 2:1296*f*
 corrosion rate predictions 2:1297*f*
 equilibrium relations 2:1287
 flow effects 2:1295, 2:1295*f*
 hydrogen sulfide (H_2S) partial pressure effects 2:1293, 2:1293*f*, 2:1294*f*
 influencing factors 2:1293
 iron sulfide (FeS) surface layer 2:1289*f*, 2:1290*f*
 localized corrosion 2:1297
 mixed hydrogen sulfide–carbon dioxide (H_2S – CO_2) saturated
 aqueous solutions 2:1289, 2:1292
- background information 3:1881
- chemical process industry and environmental technology
 acetic acid production 3:1907
 acrylic acid/acrylate ester production 3:1909
 caustic soda (NaOH) production 3:1902
 fine and specialty chemicals 3:1910
 general discussion 3:1901
 hydrofluoric acid (HF) production 3:1907
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 phosphoric acid (H_3PO_4) production 3:1905
 pollution controls 3:1912
 styrene production 3:1908
 sulfuric acid (H_2SO_4) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 tank transport studies 3:1912
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1908
- corrosion management 4:3162
- corrosion resistance 3:1882, 3:1883*f*
- corrosive agent removal (CAR) 4:2893, 4:2894*f*
- general discussion 3:1880
- historical development 3:1882*t*
- mild steel
 acid gas corrosion 2:1270–1298
 aqueous carbon dioxide (CO_2) corrosion 2:1273
 background information 2:1273
 aqueous carbon dioxide (CO_2) corrosion
 carbon dioxide (CO_2) partial pressure effects 2:1281, 2:1282*f*, 2:1283*f*
 carbonic acid (H_2CO_3) reduction reactions 2:1278
 carbonic species concentrations 2:1275*f*
 characteristics 2:1273
 condensation effects 2:1285
 corrosion inhibitors 2:1284
 corrosion rate calculations 2:1280
 crude oil effects 2:1285
 electrochemical reactions 2:1277
 equilibrium relations 2:1273, 2:1274*f*, 2:1275*f*
 flow effects 2:1283, 2:1284*f*
 glycol/methanol effects 2:1285
 hydronium (H^+) ion reduction reactions 2:1278
 influencing factors 2:1281
 iron carbonate (FeCO_3) 2:1275*f*, 2:1276*f*, 2:1290*f*
 localized corrosion 2:1286
 mixed hydrogen sulfide–carbon dioxide (H_2S – CO_2) saturated
 aqueous solutions 2:1289, 2:1292
 modeling approaches 2:1280, 2:1281*f*
 nonideal solutions/gases 2:1286
 organic acid effects 2:1285
 oxidation reactions 2:1278
 pH effects 2:1274*f*, 2:1281, 2:1282*f*
 solubility calculations 2:1287*f*
 temperature effects 2:1282, 2:1283*f*
 transport processes 2:1279
 water (H_2O) reduction reactions 2:1279
- aqueous hydrogen sulfide (H_2S) corrosion
 characteristics 2:1286
 corrosion rate calculations 2:1291, 2:1294*f*, 2:1296*f*
 corrosion rate predictions 2:1297*f*
 equilibrium relations 2:1287
 flow effects 2:1295, 2:1295*f*
 hydrogen sulfide (H_2S) partial pressure effects 2:1293, 2:1293*f*, 2:1294*f*
 influencing factors 2:1293
 iron sulfide (FeS) surface layer 2:1289*f*, 2:1290*f*
 localized corrosion 2:1297
 mixed hydrogen sulfide–carbon dioxide (H_2S – CO_2) saturated
 aqueous solutions 2:1289, 2:1292

- modeling limitations 2:1292
- pH effects 2:1287f
- pure hydrogen sulfide (H₂S) aqueous environment 2:1291
- solubility calculations 2:1287f, 2:1289f
- solubility product constants 2:1288t
- sulfide species calculations 2:1287f
- time effects 2:1294f, 2:1295, 2:1296f
- modeling approaches 2:1585–1629
 - background information 2:1586
 - general discussion 2:1626
 - kinetic models
 - active–passive transition state 2:1614, 2:1616f, 2:1617f, 2:1619f
 - adsorption phenomena 2:1604
 - charge–transfer reactions 2:1601
 - corrosion processes model 2:1611, 2:1612f
 - general discussion 2:1600
 - localized corrosion 2:1620, 2:1621f
 - mass transfer coefficients 2:1609
 - mass transport computations 2:1611
 - partial electrochemical reactions 2:1605
 - passive dissolution 2:1614, 2:1616f, 2:1617f, 2:1619f
 - porous media effects 2:1614
 - practical applications 2:1624
 - scaling effects 2:1618
 - localized corrosion
 - basic concepts 2:1620
 - critical crevice corrosion temperature (CCT) 2:1624, 2:1625f
 - passivity breakdown potential 2:1621
 - repassivation potential 2:1622, 2:1623f, 2:1624f, 2:1625f
 - schematic diagram 2:1621f
 - partial electrochemical reactions
 - anodic reactions 2:1605
 - cathodic reactions 2:1607
 - general discussion 2:1605
 - temperature dependence 2:1609
 - practical applications 2:1624
 - thermodynamic models
 - activity coefficient computations 2:1588, 2:1590t
 - alloy stability diagrams 2:1596
 - background information 2:1587
 - chemical equilibrium computations 2:1597, 2:1598f
 - electrochemical stability diagrams 2:1591, 2:1593f, 2:1596f
 - elevated temperature diagrams 2:1594
 - metastability computations 2:1599, 2:1599f
 - multiple active species effects 2:1594
 - nonideal solution diagrams 2:1595
 - potential–concentration diagrams 2:1597
 - potential–pH (Pourbaix) diagram 2:1012, 2:1591, 2:1593f, 2:1596f
 - standard-state chemical potential computations 2:1588
- molybdenum (Mo) 3:2161
- nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
 - alloy 20 3:1881t, 3:1882t, 3:1891, 3:1897t
 - alloy 31
 - corrosion loss measurements 3:1894t, 3:1895t
 - corrosion resistance 3:1892, 3:1900
 - historical development 3:1882t
 - hydrochloric acid (HCl) isocorrosion diagram 3:1894f
 - major alloying elements 3:1881t
 - pitting potential 3:1895f
 - pitting resistance 3:1894f, 3:1897t, 3:1901t
 - stability limits 3:1895f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1893f
 - alloy 33
 - corrosion loss measurements 3:1896t, 3:1897t
 - corrosion resistance 3:1892, 3:1896f
 - historical development 3:1882t
 - major alloying elements 3:1881t
 - pitting resistance 3:1894f, 3:1897t
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897f
 - alloy 825 3:1881t, 3:1882t, 3:1891, 3:1897t, 3:1908
 - alloy G-3 3:1881t, 3:1882t, 3:1891, 3:1894t, 3:1907
 - alloy G-30 3:1881t, 3:1882t, 3:1891, 3:1896t
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - major alloying elements 3:1881, 3:1881t
- nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 - alloy 22 3:1881t, 3:1887, 3:1888f, 3:1890t, 3:1891f
 - alloy 59
 - corrosion loss diagram 3:1888f
 - corrosion rates 3:1889f
 - corrosion resistance 3:1887, 3:1900
 - hydrochloric acid (HCl) isocorrosion diagram 3:1888f
 - major alloying elements 3:1881t
 - pitting resistance 3:1894f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1888f
 - thermal stability 3:1890t, 3:1891f
 - time–temperature–sensitization diagram 3:1891f
 - alloy 625 3:1899
 - corrosion loss diagram 3:1888f
 - corrosion rates 3:1889f
 - corrosion resistance 3:1890
 - major alloying elements 3:1881t
 - pitting resistance 3:1894f
 - time–temperature–sensitization diagram 3:1891f
 - alloy 686 3:1881t, 3:1889, 3:1890t, 3:1891f
 - alloy 2000 3:1881t, 3:1889, 3:1890t, 3:1891f
 - alloy C-4 3:1881t, 3:1887, 3:1888f, 3:1891f, 3:1900
 - alloy C-276
 - corrosion loss diagram 3:1888f
 - corrosion rates 3:1889f
 - corrosion resistance 3:1886, 3:1900
 - major alloying elements 3:1881t
 - pitting resistance 3:1894f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1887f
 - thermal stability 3:1890t
 - time–temperature–sensitization diagram 3:1891f
 - alloy MAT 21 3:1881t, 3:1889
 - general discussion 3:1886
 - historical development 3:1882t
 - major alloying elements 3:1881, 3:1881t
 - materials selection 2:982f
- nickel–chromium (Ni–Cr) alloys
 - corrosion resistance 3:1885, 3:1886f
 - historical development 3:1882t
 - major alloying elements 3:1881, 3:1881t
- nickel–copper (Ni–Cu) alloys
 - corrosion resistance 3:1883
 - historical development 3:1882t
 - major alloying elements 3:1881, 3:1881t
 - materials selection 2:982f
- nickel–molybdenum (Ni–Mo) alloys
 - corrosion resistance 3:1884, 3:1885f
 - historical development 3:1882t
 - major alloying elements 3:1881, 3:1881t
 - time–temperature–notch impact energy diagram 3:1885f
- principal alloys 3:1881, 3:1881t
- sacrificial anode performance 4:2770, 4:2771f, 4:2772f
- steel
 - anode and cathode separation 3:1708, 3:1708f
 - flow rate effects 3:1708
 - mass transport processes 3:1708
- tungsten (W) 3:2155
- uranium compounds 3:2183
- water system modifications 4:2930–2970
 - chemical inhibitors
 - cooling systems 4:2964, 4:2965t, 4:2968f
 - general discussion 4:2961
 - steam boiler systems 4:2961
 - closed-loop water systems 4:2943
 - cooling systems 4:2964, 4:2965t, 4:2968f
 - corrosion mechanisms
 - concentrated cell/crevice corrosion 4:2947
 - condensate line corrosion 4:2948
 - crevice corrosion 2:766
 - erosion 4:2948
 - galvanic corrosion 4:2946
 - general discussion 4:2945
 - grooving corrosion 4:2948
 - impingement attacks 4:2948
 - microbially-induced corrosion (MIC) 4:2949, 4:2949f, 4:2967, 4:2969t
 - pitting corrosion 4:2945, 4:2946f

- aqueous corrosive environments (*continued*)
- stress corrosion 4:2947
 - uniform corrosion 4:2945
 - white rust 4:2949
- heat capacity 4:2931
- importance 4:2931
- industrial heating and cooling systems
- alkalinity 4:2939, 4:2939*t*, 4:2940*t*, 4:2953, 4:2958
 - bacterial growth count evaluation 4:2969*t*
 - blistering 4:2958*f*
 - chemical inhibitors 4:2961
 - contaminant cycles of concentration (COC) 4:2959*t*, 4:2960, 4:2961*t*
 - contaminant saturation conditions 4:2956
 - cooling systems 4:2964, 4:2965*t*, 4:2968*f*
 - corrosion mechanisms 4:2945
 - corrosion mitigation 4:2933, 4:2936*f*
 - corrosion monitoring 4:3143
 - corrosion rate quantification 4:2957*t*
 - corrosion test coupon 4:2956*f*
 - corrosion vulnerability data 4:2956*t*
 - freshwater consumption 4:2932, 4:2935*f*
 - hardness 4:2940–2941, 4:2953, 4:2958
 - hydrologic cycle 4:2936, 4:2937*f*
 - Langelier saturation index (LSI) 4:2958
 - Larson–Skold index (L–SI) 4:2960
 - makeup water treatment 4:2959*t*
 - metal and alloy materials selection 4:2955, 4:2956*t*
 - microbially-induced corrosion (MIC) 4:2967, 4:2969*t*
 - microbiological fouling 4:2950, 4:2950*f*, 4:2967, 4:2969*t*
 - mineral scales, muds, and sludges 4:2941, 4:2942*f*, 4:2942*t*, 4:2943*f*
 - organic inhibitors 4:2966, 4:2966*f*
 - pathogenic bacteria 4:2951, 4:2951*f*
 - pretreatment processes 4:2953, 4:2954*f*
 - Puckorius scaling index (PSI) 4:2959
 - Ryznar stability index (RSI) 4:2959
 - scale formation 4:2935, 4:2936*f*
 - steam boiler systems 4:2961
 - treatment guidelines 4:2952
 - water chemistry 4:2936, 4:2939*t*
 - water treatment factors 4:2933
- latent heat 4:2932
- new-construction HVAC systems 4:2944
- organic inhibitors 4:2966, 4:2966*f*
- potable systems
- alkalinity 4:2939, 4:2939*t*, 4:2940*t*, 4:2953, 4:2958
 - bacterial growth count evaluation 4:2969*t*
 - blistering 4:2958*f*
 - chemical inhibitors 4:2961
 - contaminant cycles of concentration (COC) 4:2959*t*, 4:2960, 4:2961*t*
 - contaminant saturation conditions 4:2956
 - corrosion mechanisms 4:2945
 - corrosion mitigation 4:2933, 4:2936*f*
 - corrosion rate quantification 4:2957*t*
 - corrosion test coupon 4:2956*f*
 - corrosion vulnerability data 4:2956*t*
 - freshwater consumption 4:2932, 4:2935*f*
 - hardness 4:2940–2941, 4:2953, 4:2958
 - hydrologic cycle 4:2936, 4:2937*f*
 - Langelier saturation index (LSI) 4:2958
 - Larson–Skold index (L–SI) 4:2960
 - makeup water treatment 4:2959*t*
 - metal and alloy materials selection 4:2955, 4:2956*t*
 - microbially-induced corrosion (MIC) 4:2967, 4:2969*t*
 - microbiological fouling 4:2950, 4:2950*f*, 4:2967, 4:2969*t*
 - mineral scales, muds, and sludges 4:2941, 4:2942*f*, 4:2942*t*, 4:2943*f*
 - pathogenic bacteria 4:2951, 4:2951*f*
 - pretreatment processes 4:2953, 4:2954*f*
 - Puckorius scaling index (PSI) 4:2959
 - Ryznar stability index (RSI) 4:2959
 - scale formation 4:2935, 4:2936*f*
 - treatment guidelines 4:2952
 - water chemistry 4:2936, 4:2939*t*
 - water treatment factors 4:2933
- steam boiler systems 4:2961
- welded-state corrosion behavior
- heat-affected zone (HAZ) 3:1894–1895, 3:1898, 3:1898*f*
 - intercrystalline corrosion (IC) 3:1894–1895, 3:1900
 - pitting resistance 3:1900
 - surface conditions and treatment 3:1899
- zinc/zinc alloys 3:2083
- zirconium/zirconium alloys
- alkaline solutions 2:1204, 3:2124
 - cooling waters 3:2112
 - hydrogen peroxide (H₂O₂) 3:2124
 - inorganic acids 3:2113
 - organic acids
 - acetic acid 3:2125
 - chlorinated organic compounds 3:2126
 - formic acid 3:2125
 - pressurized water and steam 3:2112
 - salt solutions 3:2113, 3:2113*t*
 - sulfur compounds 3:2113
 - urea 3:2125
- aqueous electrolytes 4:2582, 4:2582*f*
- Arabian Gulf 2:1109*t*
- aragonite (CaCO₃) 4:2942*t*
- Aramid 3:2388*f*
- archaeological metals 2:1159, 4:3310, 4:3311*f*, 4:3312*f*
- Archard wear law 2:1010
- argon (Ar)
- argon–oxygen decarburization (AOD) 3:1882
 - atmospheric gases 2:1053*t*
 - steam and steam/hydrogen environments 1:408, 1:410*f*, 1:412*f*
- Arrhenius relation
- fiber reinforced plastics (FRPs) 3:2392, 3:2403
 - low-alloy steel oxidation 1:560*f*
 - oxide scale growth 1:117–118, 1:122*f*, 1:345
 - surface energy–temperature relationship 1:344
- arsenic (As)
- arsenic oxide (As₂O₃) 3:2197*f*
 - copper–chromium–arsenic (CCA) preservatives 2:1327, 3:2441
- artifact corrosion 2:1326
- ash 1:459, 1:459*t*
- Aspergillus* spp. 4:2933–2934
- asphalt/epoxy mastic 3:2342, 4:2668*t*
- ASSET (Alloy Selection System for Elevated Temperatures) program 1:242, 1:243
- asset integrity management (AIM) 4:3086, 4:3088*f*
- Atlantic Ocean 2:1109*t*
- atmosphere 2:1051–1093
- atmospheric conditions
- aerosols
 - characteristics 2:1059
 - cloud nucleation 2:1062, 2:1063*f*
 - compositions 2:1061
 - deliquescent relative humidity (DRH) 2:1060, 2:1061*t*
 - marine aerosols 2:1059, 2:1061, 2:1067
 - pH 2:1061
 - size distributions 2:1060*f*
 - sources 2:1059
 - surface moisture effects 2:1077
 - transport mechanisms 2:1065, 2:1067, 2:1069*f*, 2:1070*f*
- aqueous phase reactions
- absorption processes 2:1055
 - gas/aqueous phase reactions 2:1056
 - general discussion 2:1055
 - Henry's law coefficients for common gases 2:1056*t*
 - ionic reactions 2:1057
 - oxidation reactions 2:1056
 - secondary reactions 2:1056
- atmospheric gases
- characteristics 2:1053, 2:1053*t*
 - hydrogen peroxide (H₂O₂) 2:1055
 - moisture layer interactions 2:1054
 - nitrogen-containing compounds 2:1054, 2:1054*t*
 - organic acids 2:1055
 - ozone (O₃) 2:1054*t*, 2:1055, 2:1056*t*
 - sulfur-containing compounds 2:1054, 2:1054*t*
- atmospheric systems
- ammonia–nitric acid–sulfuric acid–water (NH₃–HNO₃–H₂SO₄–H₂O) systems 2:1058
 - ammonia–nitric acid–water (NH₃–HNO₃–H₂O) systems 2:1058

- general discussion 2:1057
 sulfuric acid–ammonia–water ($\text{H}_2\text{SO}_4\text{--NH}_3\text{--H}_2\text{O}$) systems 2:1057, 2:1058*f*
 characteristics 2:1052
 cloud nucleation 2:1062, 2:1063*f*
 rain chemistry 2:1062, 2:1063*f*, 2:1064*r*
 redox potential–pH variations 2:1065, 2:1066*f*
 atmospheric corrosion
 aluminum alloys 3:1996
 atmospheric galvanic tests 2:1503, 2:1504*f*, 2:1505*f*, 2:1506*f*
 cast iron 3:1750, 3:1751*t*, 3:1752*f*, 3:1752*r*
 copper/copper alloys 3:1946, 3:1947*r*
 corrosive agent removal (CAR) 4:2892
 general discussion 2:1090
 hot-dipped zinc coatings 4:2558, 4:2559*r*, 4:2560*r*
 iron–nickel (Fe–Ni) alloys 3:1790, 3:1791*f*, 3:1791*r*
 lead (Pb) 3:2060
 maraging steels 3:1795, 3:1797*f*
 monitoring techniques 4:3145
 stainless steels
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*r*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 2:848*f*, 3:1858, 3:1858*r*
 steel
 acid regeneration cycle 3:1718
 air-borne pollutants 3:1715, 3:1715*t*, 3:1716*f*
 alloying effects 3:1720*f*, 3:1722*f*, 3:1723, 3:1724*f*
 atmospheric corrosivity classifications 3:1725, 3:1726*t*, 3:1727*r*
 climatic variation 3:1720, 3:1721*r*
 corrosion kinetics 3:1720
 corrosion mechanisms 3:1718
 corrosion product composition 3:1719
 corrosion rates 3:1722, 3:1722*f*, 3:1723*r*
 electrochemical effects 2:1088
 electrochemical mechanisms 3:1719
 environmental influences 3:1714
 exposure conditions 3:1721
 next generation weathering steels 3:1725, 3:1725*r*
 particulate matter 3:1715*f*, 3:1717, 3:1718*r*
 relative humidity (RH) 3:1714, 3:1715*f*, 3:1715*r*
 sea salt 3:1718*r*
 urban/rural/marine atmospheres 2:848*f*
 weathering steels 3:1723, 3:1724
 wet/dry cycles 3:1719, 3:1720*f*, 3:1723, 3:1725*f*
 testing methods 2:1502
 uranium (U) 3:2185
 zinc/zinc alloys
 environmental conditions 3:2081, 3:2083*f*
 United Kingdom 3:2082*r*
 urban/rural/marine atmospheres 3:2083*r*
 white rust 3:2083, 4:2563–2564, 4:2949
 deposition processes
 building deposition rates 2:1070, 2:1073*f*, 2:1073*r*
 deposition efficiencies 2:1072*r*
 deposition mode comparison studies 2:1074, 2:1074*r*, 2:1075*f*
 deposition rates 2:1073*f*, 2:1073*r*
 deposition velocity studies 2:1070, 2:1071*f*
 dry deposition rates 2:1073*r*
 gas and particle deposition 2:1070, 2:1071*f*, 2:1073*f*, 2:1073*r*
 general discussion 2:1069
 rainfall 2:1069
 shape coefficients 2:1072*r*
 environmental conditions 2:1082, 2:1082*r*
 surface cleaning
 general discussion 2:1075
 pollutant transfer mechanisms 2:1077
 rainfall 2:1075, 2:1076*f*, 2:1077
 wind speed effects 2:1076
 surface moisture
 aerosol effects 2:1077
 condensation effects 2:1078, 2:1081, 2:1081*r*
 evaporation
 evaporation rates 2:1079, 2:1080*f*, 2:1081*r*
 general discussion 2:1078
 metal surfaces 2:1078, 2:1079*f*, 2:1080*f*
 porous surfaces 2:1081, 2:1081*r*
 rainfall effects 2:1077
 relative humidity (RH) 2:1077
 rewetting effects 2:1078
 surface reactions
 electrochemical effects
 basic concepts 2:1084
 oxide films 2:1086, 2:1087*f*, 2:1088*f*, 2:1089*f*
 steel corrosion 2:848*f*, 2:1088
 equilibrium conditions 2:1082
 potential–pH (Pourbaix) diagram 2:1083*f*, 2:1084*f*
 transport mechanisms
 gases and aerosols
 aerosol transport analyses 2:1067, 2:1069*f*, 2:1070*f*
 gas transport analyses 2:1067, 2:1068*f*
 scale of movement 2:1065, 2:1067*f*
 atomic force microscopy (AFM)
 background information 2:1439
 general discussion 2:1441
 implementation processes 2:1440
 limitations 2:1440
 operating principles 2:1439, 2:1439*f*
 solid/liquid interface applications 2:1440, 2:1441*f*
 attenuated total reflection spectroscopy
 basic concepts 2:1402
 characteristics 2:1376*r*
 Auger electron spectroscopy (AES)
 atmospheric corrosion 3:2072
 basic concepts 2:1384
 characteristics 2:1376*r*
 energy diagram 2:1384*f*
 passive film analysis 2:746, 3:1923, 3:2244
 ultrahigh vacuum (UHV) conditions 2:1376
 austenitic cast irons 3:1748, 3:1749*t*, 3:1764*f*, 3:1768*f*, 3:1784*r*
 austenitic nickel cast iron 3:1744, 3:1744*f*, 3:1745*t*, 3:1756*r*
 austenitic stainless steels
 acid pickling 4:2993*r*
 alkali corrosion 2:1198*f*, 2:1199*f*
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209*f*, 2:1212*f*
 anodic protection 4:2874*t*, 4:2878
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*r*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 3:1858, 3:1858*r*
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1855*t*, 3:1863*t*, 3:1864*t*, 3:1874*r*
 chemical plant heating/cooling waters 2:1334
 chromium-containing alloys 1:591, 1:591*f*, 1:592*f*, 1:592*t*, 1:593*f*
 commercial applications
 art and architecture 3:1858*f*, 3:1866, 3:1867*f*, 3:1866*f*
 domestic products/kitchenware 3:1860, 3:1861*r*
 process industry
 copper production 3:1862
 corrosion resistance 3:1863
 desalination 3:1863, 3:1865*f*
 hydrometallurgy 3:1861
 nickel production 3:1862
 oil and gas production 3:1867, 3:1869
 pulp and paper industry 3:1865
 wastewater treatment 3:1870
 zinc production 3:1862
 compositional ranges 3:1808*r*
 corrosion properties
 alloy composition influence 3:1825, 3:1826*f*
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830*f*
 crevice formers 3:1850*f*
 critical crevice corrosion temperature (CCT) 3:1850*f*
 critical pitting temperature (CPT)
 alloying element influences 3:1829*f*
 basic concepts 3:1827
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*

- austenitic stainless steels (*continued*)
 photographic illustration 3:1829f
 potential dependence 3:1828f
 electrochemical reactions 3:1823, 3:1824f
 electrochemical testing methods 3:1846, 3:1847f
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845f
 general corrosion
 alkaline solutions 3:1843, 3:1844f
 characteristics 3:1838
 hydrochloric acid (HCl) 3:1840, 3:1840f
 nitric acid (HNO₃) 3:1842
 organic acids 3:1842, 3:1843f
 phosphoric acid (H₃PO₄) 3:1841, 3:1841f, 3:1842f
 sulfuric acid (H₂SO₄) 3:1838, 3:1839f, 3:1840f
 general discussion 3:1821
 grade resistance 3:1847, 3:1848f, 3:1849f, 3:1850f
 grade screening methods 3:1849, 3:1850f
 intergranular corrosion 3:1845, 3:1845f
 laboratory tests 3:1850, 3:1851f
 localized corrosion 3:1824
 material selection tests 3:1849
 passive films 3:1822, 3:1822f
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826f
 pitting potentials 3:1849f
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825f
 polarization curves 3:1824f
 postweld treatments 3:1837
 stress corrosion cracking (SCC)
 alkaline solutions 2:1200, 3:1833
 atmospheric environments 3:1834, 3:1835f
 characteristics 3:1830, 3:1831f
 chlorine-induced mechanisms 3:1832, 3:1832f
 film-induced cleavage 3:1831
 hydrogen embrittlement 3:1831
 hydrogen-induced stress cracking (HISC) 2:859, 2:859f, 3:1833
 laboratory tests 3:1850, 3:1851f
 material selection tests 3:1849
 process mechanisms 3:1831
 slip dissolution 3:1831
 stress intensity factor–crack rate relationship 3:1832, 3:1832f
 sulfide stress cracking (SSC) 2:859, 2:859f, 2:860f, 3:1833
 welding-related corrosion 3:1837
 crevice corrosion 2:759
 cyclic oxidation 1:592f, 1:592t, 1:593f
 design-based mitigation 4:3070f, 4:3071f
 electrochemical scanning tunnel microscopy (ECSTM) 2:1436
 erosion resistance 2:985f
 flow-induced corrosion 2:982f, 2:983f
 galvanic corrosion 2:851t, 2:852t, 2:853t
 high temperature oxidation behavior 1:553, 1:554f
 high-temperature stainless steels
 chemical compositions 3:1874t
 corrosion resistance 3:1873
 halogen gas corrosion 3:1876
 molten metal environments 3:1877
 molten salt environments 3:1876
 oxidation behaviors 3:1875, 3:1875f
 sulfur attacks 3:1876
 hydrochloric acid (HCl) 2:1212f, 2:1213f
 hydrofluoric acid (HF) 2:1212f
 hydrogen embrittlement 2:920, 2:920f
 hydrogen sulfide (H₂S) environments 2:983f
 immersion tests/test compounds 3:1863, 3:1864t
 intergranular corrosion
 anodic polarization curves 2:816f
 general discussion 2:810
 grain boundary attack susceptibility 2:813, 2:813f
 grain boundary structure and network 2:812
 grain dropping 2:811f
 knife line attacks 2:818
 metallurgical aspects 2:812
 polarization curves 2:824f
 sensitization conditions 2:815, 2:815f, 2:816f, 2:817f
 sensitization prevention 2:817
 standard practices and test methods 2:822t, 2:824f
 theoretical aspects 2:811
 time–temperature–precipitation (TTP) diagram 2:816, 2:817f, 2:818f
 weld decay 2:818, 2:818f
 isothermal air behavior 1:591f
 marine corrosion 2:1125
 mechanical properties 3:2137t
 cold work effects 3:1815, 3:1816f
 fatigue properties 3:1816, 3:1816f, 3:1817t
 general discussion 3:1812
 room temperature conditions 3:1812, 3:1813t
 stress–strain plots 3:1813f
 tempering temperature effects 3:1814f
 toughness impacts 3:1815, 3:1816f
 microstructure 3:1809f, 3:1811
 natural water environments
 chlorination effects 3:1852, 3:1852f
 drinking water 3:1853
 freshwater 3:1853, 3:1854f
 general discussion 3:1851
 microbially-induced corrosion (MIC) 3:1851, 3:1852f
 river waters 3:1853
 seawater
 anaerobic conditions 3:1857
 cathodic protection 3:1856
 exposure factors 3:1856, 3:1856t, 3:1857t
 hydrogen embrittlement 3:1856
 materials selection 3:1854, 3:1855f
 polluted environments 3:1855
 resistance factors 3:1854, 3:1855t
 neural network method case study
 carbonate concentration effects 2:1689f
 chloride concentration effects 2:1688f
 general discussion 2:1687
 hydroxide concentration effects 2:1690f
 nitrate concentration effects 2:1689f
 sulfate concentration effects 2:1688f
 temperature effects 2:1690f
 nitric acid (HNO₃) 2:1253
 nitridation processes 1:263f, 1:264f
 noble metal additions 3:2241t
 oxide overlay coatings 1:698f
 physical properties 3:1819, 3:1820t
 precipitation/embrittlement
 carbide/nitride precipitation 3:1817
 carburization 3:1818
 475°C embrittlement 3:1817
 general discussion 3:1817
 heat treatments
 general discussion 3:1818
 precipitation hardening 3:1819
 quenching 3:1818
 solution annealing 3:1818, 3:1818t
 stabilization annealing 3:1819
 tempering 3:1819
 intermetallic phases 3:1817
 primary uses 3:1807
 process equipment materials 4:3210–3211
 property relationships 3:1820
 refractory austenitic stainless steels 1:598t
 Schaeffler–Delong diagram 3:1811f
 spalling tendencies 1:591f
 steam and steam/hydrogen environments
 construction materials 1:432t
 general discussion 1:431
 inner scale formation 1:443f
 long-term behavior 1:436, 1:437f, 1:438f, 1:439f
 oxidation rates 1:440f, 1:441f, 1:442f
 pressure effects 1:449, 1:450f
 scale growth rate 1:445, 1:445f
 scale morphology 1:447f, 1:448f, 1:449f, 1:450f
 spalling tendencies 1:439f
 steam oxidation mechanisms 1:433, 1:434f, 1:435f
 temperature dependence effects 1:440, 1:440f, 1:441f, 1:442f, 1:443f, 1:445f
 time-based mass change 1:446f
 void and gap formation 1:435, 1:436f, 1:437f, 1:438f, 1:439f
 weight change comparisons 1:433f, 1:442f, 1:444f

stress corrosion cracking (SCC) 2:867*t*, 2:872*f*, 3:1835, 4:3061*f*
 sulfuric acid (H₂SO₄) environments 2:1232*f*, 2:1235, 2:1237*f*
 surgical implants 2:1308
 thermal expansion coefficients 1:145*f*
 weight loss 1:592*t*
 welding processes 3:2458, 3:2459*f*
 automotive industry
 aluminum alloys 4:3170
 corrosion management 4:3167–3174
 background information 4:3167
 corrosion mechanisms 4:3168
 economic aspects 4:3174
 environmental conditions 4:3167
 paint systems
 antichip coatings 4:3173
 anticorrosive waxes 4:3173
 general discussion 4:3171
 pretreatment guidelines 4:3171
 primers 4:3172
 seam sealants 4:3173
 surfacers 4:3173
 underbody protection 4:3173
 prevention strategies
 design improvements 4:3170
 general discussion 4:3169
 material advancements 4:3170
 paint systems 4:3171
 vehicle bodywork 4:3167, 4:3168*f*
 magnesium alloys 3:2037, 3:2038*f*
 AWWA/DIPRA (American Water Works Association/Ductile Iron Pipe
 Research Association) soil assessment system 2:1162, 2:1163*f*
 azoles 4:2966
 Aztac test 2:1472

B

Bacillus spp. 4:2949, 4:2920
 backscattered Kikuchi diffraction (BKD) 2:1411, 2:1413*f*
 bacteria
 acid-producing bacteria (APBs) 4:2949, 4:3279
 airframe corrosion 4:3177
 characteristics 2:1170
 general aerobic bacteria (GAB) 4:2920
 industrial heating and cooling systems 4:2933, 4:2943, 4:2949,
 4:2950
 iron-oxidizing bacteria 3:1775
 iron-related bacteria (IRBs) 4:2949
 monitoring techniques 4:2922*f*, 4:3135, 4:2920
 oil and gas industry
 biocide application procedures 4:2922
 biocide treatments 4:2922
 corrosion effects 4:2922*f*, 4:2920
 monitoring techniques/serial dilution 4:2922*f*, 4:2920
 pathogenic bacteria 4:2951, 4:2951*f*
 potable water systems 4:2949
 seawater-based aerobic biofilms 2:1111, 2:1182
 sulfate-reducing bacteria (SRB)
 acid corrosion
 concrete degradation 2:1180
 fungi 2:1181
 sulfuric acid (H₂SO₄) 2:1179, 2:1180*f*, 2:1181*f*
 black water corrosion 2:1175*f*, 2:1176
 cast iron 3:1775
 copper/copper alloys 2:1178, 2:1178*f*
Desulfovibrio spp. 2:1174, 2:1174*f*
 environmental conditions 2:1174, 2:1175*f*, 2:1176*f*
Gallionella spp. 2:1177, 2:1178*f*, 2:1183, 4:2920
 industrial heating and cooling systems 4:2949
 iron corrosion 2:1176, 2:1177*f*
 lead (Pb) 3:2063
 low-alloy steel 2:1176, 2:1177*f*
 marine environments 2:1114–1115
 oil and gas industry 4:2920
 pipeline corrosion management 4:3279, 4:3295
 seawater constituents 2:1109, 2:1109*t*
 stainless steels 2:1176, 2:1177*f*, 2:1178*f*
 sulfur-oxidizing bacteria
 acid corrosion 2:1179, 2:1180*f*, 2:1181*f*
 concrete degradation 2:1180
 zirconium/zirconium alloys 3:2110
 baked carbon 3:2272, 3:2275*t*
 ballast tanks
 coating selection criteria 4:2692
 coating types and schemes 4:2694*t*
 interior photograph 4:2693*f*
 schematic diagram 4:2684*f*
 square meters of steel 4:2684*t*
 Baltic Sea 2:1109*t*
 barium (Ba)
 barium oxide (BaO) 3:2308*t*, 3:2321*t*, 3:2331*t*
 corrosion-resistant coatings 4:2995*t*
 barrier coatings 1:509, 1:510*f*, 1:511*f*, 2:949
 basic oxides 3:2316
 batteries, lead-acid 3:2065
 bauxite 3:1975
see also aluminum (Al)
 bayerite 2:1086–1087, 2:1087*f*
 Bayes' theory
 Bayes' theorem 2:1557
 general discussion 2:1557
 prior and posterior possibilities 2:1558
 prior predictive possibility 2:1558
 probability theories 2:1557
 risk-based assessments 4:3016–3017
 robust Bayes method 2:1559
 specifying the prior 2:1558
 uninformative prior possibility 2:1558
 wall thickness measurements 2:1569
Beggiatoa spp. 4:2920
 bentonite 3:2331*t*
 benzene 3:2380*t*
 benzimidazole 4:2896*f*
 benzotriazole (BTA) 3:1967, 4:3332, 4:3333*f*
 benzylamine 4:2998*t*
 benzylmercaptan 4:2896*f*
 Bering Sea 2:1109*t*
 beryllium (Be) 3:2168–2180
 aqueous corrosion behavior
 chloride concentrations 3:2170, 3:2170*f*, 3:2171*f*
 commercial grades 3:2169
 corrosion controls 3:2174
 corrosion current density 3:2170, 3:2170*f*
 environmental fracture 3:2173
 galvanic effect–impurity relationships 3:2173, 3:2173*f*
 high-purity beryllium
 corrosion pits 3:2172*f*
 corrosion resistance 3:2171
 damage events 3:2172*f*
 potentiodynamic polarization parameters 3:2171–2172, 3:2171*t*,
 3:2172*f*
 surface orientation 3:2171*t*
 passive current density 3:2169–2170, 3:2170*f*
 beryllium oxide (BeO) 3:2169*t*, 3:2197*f*
 chromium beryllide (CrBe₂) 3:2177
 copper–nickel–beryllium (CuNiBe) intermetallic compound 3:2177
 crystal structure 1:55*t*
 extraction and fabrication processes 3:2168
 galvanic corrosion 2:831*f*, 2:1119*f*
 high-temperature oxidation
 beryllium (Be)
 dry carbon dioxide (CO₂) effects 3:2176*f*
 general discussion 3:2174
 moist carbon dioxide (CO₂) effects 3:2177*f*
 temperature effects 3:2175*f*
 beryllium (Be) intermetallics (beryllides)
 general discussion 3:2177
 temperature effects 3:2178*f*, 3:2179*f*
 iron aluminum beryllide (FeAlBe₄) 3:2173, 3:2173*f*
 iron beryllide (FeBe₃) 3:2173, 3:2173*f*
 magnesium alloys 3:2015
 metallurgical properties 3:2168, 3:2169*t*
 niobium beryllide (NbBe₃) 3:2177
 nitric acid (HNO₃) solutions 2:1252*t*

- beryllium (Be) (*continued*)
 tantalum beryllide (TaBe₂) 3:2177
 titanium beryllide (FeBe₂) 3:2177
 titanium beryllide (FeBe₁₂) 3:2173, 3:2173f
 vanadium beryllide (VBe₂) 3:2177
 zirconium beryllide (ZrBe₂) 3:2177, 3:2178f, 3:2179f
- beta(β)-radiation 2:1330
- BET (Brunauer–Emmett–Teller) reaction 3:1714
- bile 2:1312f
- bimetallic corrosion 1:95t, 2:1325, 2:1470, 3:1988, 3:2081
see also galvanic corrosion
- biocidal coatings 2:1187, 4:2691–2692, 4:2692t, 4:2949
- biocide treatments
 biocide application procedures 4:2922
 biocide treatments 4:2922
- biocorrosion 4:2949
- biofilms
 characteristics 2:1172
 crevice corrosion 2:758
 formation processes 2:1173f
 industrial heating and cooling systems 4:2949
 oil and gas industry 4:2922f, 4:2920
 scale formation 2:1103
 seawater-based aerobic biofilms 2:1111, 2:1182
 stainless steel corrosion 3:1851, 3:1852f
- biological slimes 2:1111, 2:1182
- biomass corrosivity 1:402, 4:2949
- biomedical devices
 advanced technical ceramics 3:2294, 3:2303
 corrosion-resistant alloys
 cobalt–chromium–molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
 corrosion types
 corrosion fatigue 2:1318, 3:2049
 crevice corrosion 2:1317
 fretting corrosion 2:1318
 galvanic corrosion 2:1319
 general corrosion 2:1316
 general discussion 2:1319
 hydrogen embrittlement 2:1317
 pitting corrosion 2:1317
 stress corrosion cracking (SCC) 2:1317
 dental amalgams 2:1316
 environmental conditions 2:1311, 2:1312f
 health effects 2:1310, 2:1310t
 historical background 2:1308
 magnesium alloys 2:1315
 metallic foams 2:1315
 nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
 niobium (Nb) 3:2148
 oral cavity 2:1312–1313
 porous materials 2:1315
 rare earth magnets 2:1310, 2:1316
 safety concerns 2:1308
 stainless steels 2:764, 2:1314
 surface finish 2:1313
 tantalum (Ta) 3:2148
 titanium nitride (TiN) coatings 2:1316
 titanium/titanium alloys 2:764, 2:1310, 2:1313, 2:1317, 3:2049, 3:2164
 tetragonal zirconia polycrystals (TZP) 3:2294
see also surgical implants
- bio-tribocorrosion
 dentistry 2:1045, 2:1046t
 replacement joints 2:1046, 2:1046f, 2:1047f
- birch 2:1325t
- bismuth (Bi)
 anodic protection 4:2874t
 bismuth oxide (Bi₂O₃) 3:2197f
 corrosive environments 1:405
 galvanizing zinc melts 4:2570
 magnesium alloys 3:2019t
 nitric acid (HNO₃) solutions 2:1252t
- bisphenol A polycarbonate 3:2379t, 3:2385t
- bittiness 4:2731
- bitumen 3:2342
- bituminous coal 1:459t
- black magnetic muds 4:2944
- Black Sea 2:1109t
- black water corrosion
 flue gas composition 1:460t
 fuel chemistry 1:459, 1:459t, 1:460f
 sulfate-reducing bacteria (SRB) 2:1175f, 2:1176
 superheater deposit composition 1:461, 1:464t, 1:465f
- bleaching 4:2731, 4:2968
- bleeding/bleed through 4:2731
- blister cracking 2:924
- blistering
 coating failures
 aluminum corrosion 4:2731
 characteristics 4:2732
 marine coatings 4:2685–2686
 industrial heating and cooling systems 4:2958f
- blood
 corrosion-resistant alloys 2:1310t, 2:1311
 oxygen–carbon dioxide level comparisons 2:1311–1312, 2:1312t
- bloom/blush 4:2732
- Bode plot of impedance data 2:1359, 2:1359f
- body fluids
 corrosion-resistant alloys 2:1308–1322
 biological components 2:1311
 biomedical devices
 cobalt–chromium–molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
 corrosion fatigue 2:1318, 3:2049
 corrosion types 2:1316
 crevice corrosion 2:1317
 dental amalgams 2:1316
 fretting corrosion 2:1318
 galvanic corrosion 2:1319
 general corrosion 2:1316
 general discussion 2:1319
 health effects 2:1310, 2:1310t
 historical background 2:1308
 hydrogen embrittlement 2:1317
 magnesium alloys 2:1315
 metallic foams 2:1315
 nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
 pitting corrosion 2:1317
 porous materials 2:1315
 rare earth magnets 2:1310, 2:1316
 stainless steels 2:764, 2:1314
 stress corrosion cracking (SCC) 2:1317
 surface finish 2:1313
 titanium nitride (TiN) coatings 2:1316
 titanium/titanium alloys 2:764, 2:1310, 2:1313, 2:1317, 3:2164
 environmental conditions 2:1311, 2:1312f
 health effects 2:1310, 2:1310t
 metal ion concentrations 2:1310t
 niobium (Nb) 3:2148
 oxygen–carbon dioxide level comparisons 2:1311–1312, 2:1312t
 safety concerns 2:1308
 tantalum (Ta) 3:2148
- boehmite 2:1086–1087, 2:1087f
- Bogue compositions 3:2350, 3:2350t
- boiler water treatment
 all-polymer treatments 4:2982
 all volatile treatment (AVT) 4:2985
 caustic treatment 4:2986
 chelant treatments 4:2981
 congruent phosphate treatment 4:2983
 coordinated phosphate treatment 4:2982, 4:2983f
 equilibrium phosphate treatment 4:2984, 4:2985f
 residual phosphate treatment 4:2980, 4:2981t
 steam purity 4:2980
- boiling water reactors (BWRs)
 corrosion effects 2:1333
 crevice corrosion 2:766
 schematic diagram 2:1669f
 stress corrosion cracking (SCC)
 corrosion evolutionary path (CEP) 2:1672f
 crack depth modeling 2:1673f
 electrochemical corrosion potential (ECP) calculation 2:1670f, 2:1671f
 predicted damage plot 2:1672f
 predictive modeling 2:1669

- boron (B)
- advanced technical ceramics 3:2285
 - boric acid 3:1998
 - boron carbide (B₄C) 1:675, 3:2251, 3:2257*t*, 3:2301, 3:2302*f*
 - boron nitride (BN)
 - advanced technical ceramics
 - comparative attack rates 3:2302*f*
 - corrosion resistance 1:679, 3:2285
 - cubic boron nitride (CBN) 3:2301
 - hexagonal boron nitride (HBN) 3:2301
 - hydrolysis processes 3:2301*f*
 - material types 3:2301
 - nitridation processes 1:308*f*
 - boron oxide (B₂O₃) 3:2308*t*, 3:2321*t*, 3:2331*t*
 - borosilicate glass 2:1224, 2:1248, 3:2307, 3:2308*t*, 3:2309*t*, 3:2324*t*, 3:2325*t*
 - chromium–boron (Cr–B) alloys 1:589
 - cobalt-based alloys 3:1918*t*
 - cobalt boride (Co₂B) 3:2195
 - diffusion coatings 4:2535*t*, 4:2536*t*, 4:2548*t*
 - disodium octaborate (Na₂B₈O₁₃·4H₂O) 2:1328
 - disodium octaborate tetrahydrate (DOT) 3:2441
 - fire-retardant treatment chemicals 2:1328
 - metal–matrix composites 3:2251, 3:2257*t*
 - sacrificial anodes 4:2769
 - seawater constituents 2:1109*t*
 - titanium diboride (TiB₂) 1:680, 3:2251, 3:2301, 3:2302*f*
 - Boudouard reaction 1:274
 - bounce-back 4:2639
 - boundary element method (BEM) 2:1584
 - Bragg peaks 2:1390, 2:1390*f*
 - brass
 - acid pickling
 - hydrochloric acid (HCl) 4:2992*t*
 - nitric acid (HNO₃) 4:2993*t*
 - sulfuric acid (H₂SO₄) 4:2992*t*
 - adhesive bond failure 3:2472*f*
 - archaeological metals 4:3312–3313, 4:3313*f*
 - characteristics 3:1942
 - corrosion rates 3:1952*t*
 - corrosion vulnerability data 4:2956*t*
 - dealloying mechanisms 2:802
 - dezincification 2:807, 2:807*f*, 3:1952
 - electroplated coatings 4:2578
 - erosion resistance 2:985*f*
 - galvanic corrosion 2:831*f*, 2:851*t*, 2:852*t*, 2:1119*f*, 3:1757*t*, 3:1845*f*
 - intergranular corrosion 2:820
 - marine environments 2:1132*t*, 2:1133*f*
 - stress corrosion cracking (SCC) 2:867*t*, 3:1961
 - velocity effects 2:1459*f*
 - wood corrosivity 2:1326
 - brazing methods *see* soldering and brazing methods
 - bricks
 - aluminum alloys 3:2000
 - sulfuric acid (H₂SO₄) environments 2:1248
 - bridges *see* highway infrastructure
 - bridging 4:2732
 - brines 3:2013*t*
 - bromine (Br)
 - high-temperature stainless steels 3:1876
 - hydrobromic acid (HBr) 2:1207–1225
 - aluminum alloys 3:1999*f*
 - characteristics 2:1207
 - nickel/nickel alloys 2:1217*f*
 - hypobromous acid (HOBr) 2:1057
 - intermetallic alloys 1:659
 - methyl bromide (CH₃Br) 2:1067*f*
 - pitting corrosion 2:774*t*
 - seawater constituents 2:1109*t*
 - tantalum corrosion 3:2144
 - water chemistry 2:1098, 2:1098*t*
 - water system modifications 4:2968–2969
 - bronze
 - aluminum bronzes
 - brazed joints 3:2452
 - characteristics 3:1943, 3:1952*t*
 - flow-induced corrosion 2:982*f*
 - galvanic corrosion 2:831*f*, 2:852*t*, 2:853*t*, 2:854*t*, 2:1119*f*, 3:1845*f*
 - archaeological metals 2:1159, 4:3312–3313
 - dealloying mechanisms 2:802
 - electroplated coatings 4:2578
 - flow-induced corrosion 2:982*f*
 - galvanic corrosion 2:831*f*, 2:851*t*, 2:852*t*, 2:854*t*, 2:1119*f*, 3:1757*t*
 - manganese bronze 2:831*f*, 2:849*f*, 2:982*f*, 2:1119*f*
 - marine environments 2:1132*t*, 3:1760*f*
 - silicon bronzes 2:831*f*, 2:1119*f*, 3:1943, 3:1952*t*
 - soil corrosion 2:1153*f*
 - tin bronze 2:831*f*, 2:1119*f*, 3:1943
 - Brouwer's approximation 1:113–114
 - brown field sites 2:1153–1154
 - brown rot 3:2445
 - brucite (Mg(OH)₂) 3:2013*t*, 4:2942*t*
 - Brunauer–Emmett–Teller (BET) reaction 3:1714
 - brush marks 4:2733
 - brush plating 4:2597
 - BS EN ISO 8501 4:2723
 - BS EN ISO 8502 4:2725
 - BS EN ISO 8503 4:2724
 - bubbles/bubbling 2:1134, 4:2733
 - building stone 3:2000
 - Burgers vector 1:57, 1:58*f*, 1:104, 1:105*f*, 1:109*f*
 - buried and ground-contact structures
 - cathodic protection
 - anode backfill 4:2818
 - attenuation
 - cable materials selection 4:2821
 - coating resistance measurements 4:2821
 - drainage point measurements 4:2821, 4:2821*f*
 - field measurements 4:2820, 4:2820*f*, 4:2821*f*
 - general discussion 4:2820
 - power sources 4:2822
 - groundbed resistance
 - deep-well groundbeds 4:2819*f*, 4:2820
 - rectifier voltage determinations 4:2820
 - resistance calculations 4:2818
 - impressed current designs 4:2817, 4:2819*f*
 - soil resistivity 4:2816, 4:2816*f*
 - crevice corrosion 2:768
 - field signature monitoring method (FSM) 4:3131, 4:3132*f*, 4:3133*f*
 - soil corrosion 4:2702
 - steel corrosion
 - buried steel
 - long-term burial 3:1733
 - pilings 3:1732
 - pipelines 3:1733
 - controlling factors 3:1731, 3:1732*t*
 - stray-current corrosion 3:2062
 - butadiene rubber (BR) 3:2411, 3:2412*t*, 3:2413*f*, 3:2416*t*
 - butanenitrile 3:2380*t*
 - butanol 3:2380*t*
 - Butler–Volmer equation
 - out-of-equilibrium conditions
 - current-overpotential curve 1:35*f*
 - large overpotential limit 1:37, 1:38*f*
 - quantitative approach 1:33
 - small overpotential limit 1:36, 1:37*f*
 - butyl acrylate 3:1909
 - butyl rubber (IR) 3:2412*t*, 3:2413*f*, 3:2416*t*, 3:2436
 - butyric acid 2:1324
- ## C
- cadmium (Cd)
 - cadmium oxide (CdO) 3:2197*f*
 - cadmium plating methods 4:3184*t*, 4:3186, 4:3187*f*, 4:3194*t*
 - coating characteristics 4:2524
 - corrosion-resistant coatings 4:3184*t*
 - crystal structure 1:55*t*
 - electroplated coatings 4:2584
 - galvanic corrosion 2:831*f*, 2:850*t*, 2:851*t*, 2:852*t*, 2:1119*f*
 - magnesium alloys 3:2019*t*
 - nitric acid (HNO₃) solutions 2:1252*t*
 - pitting corrosion 2:774*t*, 2:782*f*

- cadwaladerite 2:1086–1087
 calcined petroleum coke 4:2789, 4:2790r
 calcite (CaCO₃) 4:2938, 4:2942r
 calcium (Ca)
 atmospheric conditions 2:1082r
 calcium carbonate (CaCO₃) 2:1100, 2:1101f, 4:2938, 4:2939r, 4:2942r, 4:2956
 calcium chloride (CaCl₂) 3:2119r, 4:2938–2939
 calcium fluoride (CaF₂) 3:2119r, 3:2301, 3:2321r, 3:2331r
 calcium nitrite (CaNO₂) 4:2997
 calcium oxide (CaO)
 amorphous alloys 3:2197f
 corrosion resistance 3:2290r
 enamel frit compositions 3:2321r, 3:2331r
 glass compositions 3:2308r
 oxide basicity 1:477f
 Portland cement 3:2349, 3:2350r
 superheater deposit composition 1:464r
 calcium phosphate (Ca₁₀(OH)₂(PO₄)₆) 2:1102, 4:2942r
 calcium sulfate (CaSO₄) 1:477f, 2:1102, 4:2938–2939, 4:2942r
 corrosion-resistant coatings 4:2995
 fuel chemistry 1:459, 1:459r
 gypsum (CaSO₄·2H₂O) 4:2938, 4:2942r
 hemihydrate (CaSO₄·1/2H₂O) 4:2942r
 lead–calcium (Pb–Ca) alloys 3:2055, 3:2055r
 magnesium alloys 3:2015, 3:2016r
 marine environments 2:1111, 2:1115–1116, 2:1117f
 nitric acid (HNO₃) solutions 2:1252r
 rain chemistry 2:1064r
 seawater constituents 2:1109, 2:1109r
 soda-lime glass 3:2324r, 3:2325r
 tetracalcium aluminoferrite (C₄AF) 3:2350r, 3:2351
 tricalcium aluminate (C₃A) 3:2350r, 3:2351
 tricalcium phosphate (Ca₃(PO₄)₂) 4:2942r
 capillary water 2:1156
 carbonylhydrazide 4:2976–2977, 4:2976f
 carbon black 4:2995
 carbon (C) 3:2271–2281
 alloying effects 1:565
 alumina-forming alloys 1:608r, 1:609r, 1:630
 aluminum carbide (Al₄C₃) 1:275r, 3:2263
 boron carbide (B₄C) 1:675, 3:2251, 3:2257r, 3:2301, 3:2302f
 carbonates
 alkaline cleaners 4:2486
 calcium carbonate (CaCO₃) 2:1100, 2:1101f, 4:2938, 4:2939r, 4:2942r, 4:2956
 iron carbonate (FeCO₃) 2:965f, 2:1275f, 2:1276f, 2:1290f, 4:2942r
 lead carbonate (PbCO₃) 3:2060r, 4:2670
 marine environments 2:1111
 molten carbonate fuel cells (MCFCs) 1:328
 molten salts
 characteristics 1:319
 gas solubility 1:319
 oxide solubility 1:320, 1:320f, 1:321f
 redox reactions 1:319
 polycarbonates 3:2384
 potassium carbonate (K₂CO₃) 3:2331r
 process equipment risk management 4:3217f
 seawater constituents 2:1109, 2:1109r
 sodium carbonate (Na₂CO₃) 3:2324r, 4:2564f
 water chemistry 2:1096, 2:1097, 2:1097f, 3:1754f, 4:2937–2938, 4:2939r
 zinc carbonate (ZnCO₃) 2:1088f, 4:2745, 4:2942r
 carbon bricks 2:1224, 2:1248, 3:2339, 3:2339r
 carbon dioxide (CO₂)
 aqueous carbon dioxide (CO₂) corrosion 2:1273
 atmospheric gases 2:1053r
 beryllium (Be) corrosion 3:2175–2176, 3:2176f, 3:2177f
 body fluid levels 2:1311–1312, 2:1312r
 combustion conditions 1:461f
 condensate treatment 4:2986
 corrosive environments 2:855f
 flue gas composition 1:460r, 1:462r, 1:463r
 Henry's law coefficients for common gases 2:1056, 2:1056f
 high-temperature oxidation 1:182r, 1:183f
 high-temperature tribocorrosion 1:373
 localized corrosion
 flow-induced localized corrosion (FILC) 4:3293
 mesa corrosion 4:2902f, 4:3293
 pitting corrosion 4:2902f, 4:3293
 low-alloy steel 1:578, 1:579f
 pipeline corrosion management 4:3291
 process equipment risk management 4:3217f
 solid oxide fuel cells (SOFCs) 1:497r
 stainless steel corrosion 3:1868
 steel reinforcement corrosion 3:2359, 3:2359f
 superheater deposit composition 1:464r
 sweet corrosion
 basic concepts 4:3291
 flow rate effects 4:3292
 hydrogen sulfide (H₂S) content effects 4:3293
 partial pressure effects 4:3292
 pH effects 4:3292
 temperature effects 4:3292
 uranium compounds 3:2184f, 3:2187
 water chemistry 2:1096, 2:1097, 2:1097f, 3:1754f, 4:2937–2938, 4:2939r
 carbon disulfide (CS₂) 2:1054, 2:1054r, 3:2380r
 carbonic acid (H₂CO₃) 2:1275f, 2:1278
 carbon monoxide (CO)
 atmospheric gases 2:1053r
 combustion conditions 1:461f
 flue gas composition 1:462r, 1:463r
 low-alloy steel 1:578, 1:579f
 process equipment risk management 4:3217f
 solid oxide fuel cells (SOFCs) 1:497r
 transport mechanisms 2:1067f
 uranium compounds 3:2184f, 3:2187
 carbon steel 3:1693–1736
 above-water fastener selection 2:847f
 acetic acid–sodium chloride mixtures 4:3059r
 acid corrosion 3:1792, 3:1792r
 adhesive bond failure 3:2473, 3:2473f, 3:2475f, 3:2476f, 3:2477f
 alkali corrosion
 anodic polarization curves 2:1194f
 corrosion rates 2:1196f
 crevice corrosion 2:1194–1195, 2:1195f
 general discussion 2:1192
 iron–water system Pourbaix diagram 2:1193f
 stress relief techniques 2:1194f
 temperature effects 2:1194f, 2:1195f
 ammonia damage 4:3220r
 ammonium nitrate (NH₄NO₃) 4:2883
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209f
 aqueous corrosion
 corrosion rates 3:1761f
 crevice corrosion 3:1711
 differential aeration cell corrosion 3:1710, 3:1710f
 erosion-corrosion 3:1712
 flow-assisted corrosion 3:1712
 galvanic corrosion 3:1711, 3:1757r
 general corrosion 3:1710
 pitting corrosion 3:1711
 protective treatments 3:1713
 solubility products 3:1712r
 tuberculation corrosion 3:1710f
 atmospheric corrosion
 acid regeneration cycle 3:1718
 air-borne pollutants 3:1715, 3:1715r, 3:1716f
 alloying effects 3:1720f, 3:1722f, 3:1723, 3:1724f
 atmospheric corrosivity classifications 3:1725, 3:1726r, 3:1727r
 climatic variation 3:1720, 3:1721r
 corrosion kinetics 3:1720
 corrosion mechanisms 3:1718
 corrosion product composition 3:1719
 corrosion rates 3:1722, 3:1722f, 3:1723r
 electrochemical mechanisms 3:1719
 environmental influences 3:1714
 exposure conditions 3:1721
 next generation weathering steels 3:1725, 3:1725r
 particulate matter 3:1715f, 3:1717, 3:1718r
 relative humidity (RH) 3:1714, 3:1715f, 3:1715r
 sea salt 3:1718r
 urban/rural/marine atmospheres 2:848f
 weathering steels 3:1723, 3:1724
 wet/dry cycles 3:1719, 3:1720f, 3:1723, 3:1725f

- below-water fastener selection 2:849f
 brazed joints 3:2451
 carbon dioxide (CO₂) environments 2:855f
 cathodic protection criteria 4:2847r
 chlorine-related corrosion 1:479f
 corrosion fatigue 2:944
 corrosion processes
 aqueous corrosion 3:1710
 corrosion products 3:1709r
 environmentally-assisted cracking 3:1712
 general discussion 3:1709
 high-temperature oxidation 3:1713
 hydrogen embrittlement 3:1713
 microbially-induced corrosion (MIC) 3:1713
 corrosion rates
 hydrochloric acid (HCl) 2:1209f, 3:1765r
 hydrofluoric acid (HF) 2:1210f, 2:1212f
 marine environments 2:1114f, 3:1761f
 sulfuric acid (H₂SO₄) 3:1792, 3:1792t, 4:2876, 4:2878f
 electrochemical effects 2:1088
 electrochemistry
 anodic dissolution 3:1704
 aqueous corrosive environments 3:1708
 cathodic reactions 3:1707
 passivity 3:1705
 potential-pH (Pourbaix) diagram 3:1702, 3:1703f, 3:1706f
 thermodynamics 3:1702
 environmentally-assisted cracking 4:3217f, 4:3218f
 erosion resistance 2:985f
 galvanic corrosion 2:1011, 2:1013f
 high-temperature oxidation 1:466f
 historical background 3:1695
 hydrogen sulfide (H₂S) damage 4:3219f
 hydrogen sulfide (H₂S) environments 2:855f
 iron-carbon (Fe-C) alloys
 equilibrium microstructures 3:1697, 3:1698f
 mechanical properties 3:1699, 3:1699r
 nonequilibrium microstructures 3:1697, 3:1698f
 phase diagram 3:1695, 3:1696f
 physical properties 3:1699, 3:1699r
 marine corrosion
 alloying element influences 3:1702f, 3:1702r
 corrosion profile 2:1121f
 corrosion rates 2:1114f, 2:1120, 2:1121t, 3:1761f
 design-based mitigation 4:3080f
 exposure rate-dissolved oxygen plot 2:1124f
 exposure rate-seawater depth plot 2:1124f
 hydrogen embrittlement 2:1123-1124
 mass loss 2:1122f
 pitting corrosion 2:1122-1123, 2:1122f, 2:1123f
 polarization curves 2:1114f, 2:1120f
 protective treatments 2:1143
 seawater velocity effects 2:1122f
 materials selection 4:3210, 4:3210f
 molybdenum additives 3:2159
 oil and gas industry facilities 4:3234
 passivation current density 4:2876f, 4:2877f
 passive range 4:2877f
 phosphoric acid (H₃PO₄) 4:2881
 potentiodynamic curves 4:2876f
 processing techniques
 alloying element influences 3:1702f, 3:1702r
 corrosion rates 3:1700, 3:1701t, 3:1702r
 marine corrosion resistance 3:1702r
 mechanical deformation 3:1700, 3:1701f
 protective barrier indcement (PBI) 4:2898f, 4:2899f
 reducing environments 1:468f
 scale inhibitors/dispersants 4:2993r
 S-N (stress-number of cycles to failure) curves 2:930f
 soil corrosion 2:1152f, 2:1157, 2:1157f
 storage tanks
 alkaline environments 4:2888
 cellulose boilers 4:2888
 liquid fertilizer storage tanks 4:2888
 sulfuric acid (H₂SO₄) 4:2887
 stress corrosion cracking (SCC) 2:867t, 2:871f, 4:3058f
 sulfidation corrosion 1:241f, 1:246f
 sulfuric acid (H₂SO₄) environments 2:1236f, 2:1238f, 4:3058f
 sweet corrosion 4:3291
 underground corrosion
 buried steel 3:1732
 controlling factors 3:1731, 3:1732r
 long-term burial 3:1733
 pillings 3:1732
 pipelines 3:1733
 water corrosion
 accelerated low water corrosion (ALWC) 3:1729
 boiler waters 3:1731
 deposits and scales 3:1728
 dissolved gases 3:1726
 dissolved solids 3:1727
 fouling deposits 3:1728
 heating and cooling systems 3:1730, 3:1731r
 height-related corrosion 3:1730, 3:1731f
 microbial effects 3:1728
 natural waters 3:1728, 3:1729r
 piped fresh water systems 3:1729, 3:1730r
 process waters 3:1730
 under-deposit corrosion 3:1728
 unprotected structural steel 3:1729
 water composition 3:1726
 wear effects 1:393f
 welding processes 3:2456, 3:2457f
 carbonyl sulfide (COS)
 atmospheric gases 2:1054, 2:1054r
 combustion conditions 1:461f
 flue gas composition 1:462r
 sulfidation corrosion
 corrosion mechanisms 1:240
 laboratory simulations 1:245, 1:254f, 1:254t, 1:255f
 parabolic rate constant plot 1:256f
 sulfidation/oxidation mechanisms 1:249, 1:250f, 1:255f, 1:256f, 1:259f, 1:260f
 thermochemical models 1:254f, 1:254t, 1:255f
 carboxylates 4:3334
 carburization 1:272-303
 alloy carburization
 alumina-forming alloys 1:551, 1:639
 carbide precipitation zones 1:278f
 chromium carbide precipitation 1:276t, 1:277r
 diffusion paths 1:278f
 heat-resisting alloys 1:282
 internal carbides 1:277r
 kinetic mechanisms 1:277, 1:279f, 1:279r
 microstructure characteristics 1:280, 1:280f, 1:281f
 partitioning effects 1:278f
 permeability data 1:276t, 1:279r
 phase diagram 1:278f
 rate variations 1:280f
 reaction morphologies 1:276
 thermodynamic properties 1:276
 alloys
 basic concepts 1:265
 carburization rates 1:269f
 corrosion mechanisms 1:265
 corrosion products prediction 1:266, 1:267f, 1:268f
 equipment concerns 1:265
 gas composition effects 1:267f, 1:268f
 general discussion 1:267
 thermochemistry 1:265
 basic concepts 1:274
 carbonaceous gas formation
 background information 1:273
 gas-phase processes 1:274, 1:274t, 1:275f
 solid oxide fuel cells (SOFCs) 1:497, 1:498f
 dissolution thermodynamics 1:275t
 environmental conditions 1:401
 general discussion 1:301
 green rot 1:401
 heat-resisting alloys
 aluminum effects 1:284, 1:285f
 carbon effects 1:283
 carburization rate constants 1:283r
 environment-based alloy selection 1:551

- carbon (C) (*continued*)
- molybdenum effects 1:283
 - niobium effects 1:284, 1:284f
 - post-carburization appearance 1:282f
 - protective treatments 1:284
 - reaction morphologies 1:282
 - silicon effects 1:283
 - metal carbide properties 1:275t
 - metal dusting
 - adsorbed sulfur protection 1:300, 1:301f
 - alumina-forming alloys 1:551, 1:639
 - austenitic iron–nickel (Fe–Ni) alloys 1:296, 1:297
 - background information 1:285
 - carbon uptake kinetics 1:297f
 - cementite decomposition 1:286–287, 1:287f, 1:288f
 - cementite formation 1:285, 1:286f, 1:287f
 - coating protection 1:300
 - coke filaments 1:286, 1:287f
 - coking rates 1:290f, 1:291f
 - environmental conditions 1:402
 - environment-based alloy selection 1:551
 - ferritic chromium steels 1:291, 1:292f, 1:293f
 - gas composition effects 1:288, 1:290f, 1:297
 - general discussion 1:301
 - graphite–cementite interface 1:287, 1:289f
 - Hochman–Grabke model 1:286f
 - iron–aluminum (Fe–Al) alloys 1:292
 - iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
 - low-alloy steel 1:290, 1:290f, 1:291f
 - mass transport model 1:287f
 - nickel alloys 1:293, 1:294f, 1:295f, 1:296f, 1:297
 - nickel–copper (Ni–Cu) alloys 1:296, 1:296f
 - non-cementite iron dusting conditions 1:288, 1:289f
 - oxide scale protection 1:298, 1:299f, 1:300f
 - oxide to carbon conversion thermodynamics 1:300f
 - risk management strategies 4:3224–3226, 4:3225f
 - solid oxide fuel cells (SOFCs) 1:497
 - temperature effects 1:288, 1:290f, 1:297
 - molybdenum carbide (Mo₂C) 3:2165
 - stainless steels 3:1818
 - chromia-forming alloys 1:608t, 1:609t
 - chromium–carbon (Cr–C) alloys 1:589
 - cobalt-based alloys 3:1918, 3:1918t
 - cobalt–chromium–carbon (Co–Cr–C) system 3:1920
 - degradation conditions
 - aqueous corrosion behavior 3:2276
 - aqueous environments 3:2276
 - galvanic corrosion 3:2278
 - high-temperature environments 3:2279
 - high-temperature oxidation 3:2278, 3:2279f
 - protective treatments 3:2279
 - diamond (C) 3:2279f
 - diffusion coatings 4:2535t
 - fluorocarbon membranes 3:2343, 3:2343t
 - fuel chemistry 1:459, 1:459t
 - graphite (C) 3:2271–2281
 - above-water fastener selection 2:847f
 - alkali corrosion 2:1205
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1224
 - anodic protection 4:2874t
 - atomic structure 3:2275f
 - background information 3:2271
 - below-water fastener selection 2:849f
 - degradation conditions
 - aqueous corrosion behavior 3:2276
 - aqueous environments 3:2276
 - galvanic corrosion 3:2278
 - high-temperature environments 3:2279
 - high-temperature oxidation 3:2278, 3:2279f
 - protective treatments 3:2279
 - galvanic corrosion 2:1119f, 3:2110t
 - galvanic series 2:831f
 - graphite–cementite interface 1:287, 1:289f
 - graphitization
 - characteristics 1:95t
 - industrial-use carbon 3:2273f
 - impressed current anodes 4:2788, 4:2789t, 4:2813
 - industrial applications 3:2275
 - industrial graphite 3:2272, 3:2275t, 3:2276, 3:2277f
 - metal dusting 1:293, 1:294f, 1:295f, 1:296f
 - metal–matrix composites 3:2251
 - nuclear graphite
 - enhanced radiolytic oxidation 3:2281
 - radiation damage 3:2280
 - physical properties 3:2274, 3:2275t
 - process equipment materials 4:3211f
 - pyrolytic graphite 3:2273, 3:2275t
 - resistivities 3:2257t
 - standard reduction potential 3:2074t
 - sulfuric acid (H₂SO₄) environments 2:1248, 4:3058f
 - heat-resisting alloys–carburization effects 1:283
 - industrial-use carbon
 - applications 3:2275
 - background information 3:2271
 - baked carbon 3:2272, 3:2275t
 - carbon composites 3:2274
 - carbon fibers 3:2273
 - degradation conditions
 - aqueous corrosion behavior 3:2276
 - aqueous environments 3:2276
 - galvanic corrosion 3:2278
 - high-temperature environments 3:2279
 - high-temperature oxidation 3:2278, 3:2279f
 - protective treatments 3:2279
 - fullerenes 3:2274, 3:2279f
 - glassy carbon 3:2273, 3:2275t, 3:2276
 - graphitization 3:2273f
 - manufacturing processes 3:2274
 - nanotubes 3:2274, 3:2279f
 - physical properties 3:2274, 3:2275t
 - surface finishing 3:2274
 - intermetallic alloys 1:656
 - iron–carbon (Fe–C) alloys
 - equilibrium microstructures 3:1697, 3:1698f
 - mechanical properties 3:1699, 3:1699t
 - nonequilibrium microstructures 3:1697, 3:1698f
 - phase diagram 3:1695, 3:1696f
 - physical properties 3:1699, 3:1699t
 - low-alloy steels 1:565
 - metallurgical properties 3:2169t
 - molten carbonate fuel cells (MCFCs) 1:328
 - physical properties 3:2274, 3:2275t
 - silico-carbonitrides 1:680
 - silicon carbide (SiC)
 - advanced technical ceramics
 - chemical vapor deposition (CVD) silicon carbides 3:2299
 - comparative attack rates 3:2302f
 - corrosion resistance 1:675, 1:676f, 3:2285
 - hot corrosion 1:675, 1:676f
 - liquid phase sintered silicon carbides 3:2299
 - material types 3:2297
 - parabolic rate constant plot 1:677f
 - partial pressure effects 1:676f
 - penetration time–temperature plot 1:679f
 - reaction-bonded silicon carbides 3:2297
 - silicon carbide/titanium carbide (SiC/TiC) composites 3:2299
 - sintered silicon carbides 1:677, 1:678f, 3:2298
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1224
 - chemically resistant bricks 3:2339, 3:2340t
 - metal–matrix composites 3:2251
 - process equipment materials 4:3211f
 - properties 1:275t
 - resistivities 3:2257t
 - sulfuric acid (H₂SO₄) environments 2:1248
 - thermal expansion coefficients 1:145f
 - stainless steels 3:1810, 3:1874t
 - steel–magnesium oxide–carbon (MgO–C) contact 1:688
 - titanium carbide (TiC) 1:680, 3:2301
 - tungsten carbide (WC) 3:1920, 3:2152, 3:2301
 - uranium carbide (UC) 3:2187
 - carboxylated nitrile rubber (XNBR)
 - applications 3:2412t
 - crosslink concentration effects 3:2428, 3:2430f, 3:2430t

- carboxylates 4:3334
 carcinogenesis
 corrosion-resistant alloys 2:1310
 nickel titanium (NiTi) alloys 2:1314
 cardiac dysfunction 2:1310
 cargo holds 4:2696, 4:2697f, 4:2697t
 cargo tanks 4:2694
 carnallite 3:2013t
 Carnot cycle 1:3-4, 1:518
 carrier fluids 4:2654
 Caspian Sea 2:1109t
 cast basalt 3:2340, 3:2341t
 cast iron 3:1737-1788
 alkali corrosion 2:1192, 2:1196f
 alloy cast irons 3:1740
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209, 2:1209f
 anodic protection 4:2876
 applications
 alkali corrosion 3:1768t
 alloyed ferritic cast irons 3:1748, 3:1748f, 3:1756f, 3:1767t, 3:1770t, 3:1771f
 austenitic cast irons 3:1748, 3:1749t, 3:1764f, 3:1768f, 3:1784t
 unalloyed cast irons 3:1747
 characteristics 3:1739
 compositions 3:1741t
 corrosion behavior
 austenitic nickel cast iron 3:1744, 3:1744f, 3:1745t, 3:1756t
 high-alloy cast irons 3:1744
 high chromium cast iron 3:1746, 3:1748f, 3:1764f
 high silicon cast iron 3:1746, 3:1747t, 3:1748t
 low-alloy lamellar cast irons 3:1742f, 3:1743, 3:1752f, 3:1759t
 spheroidal graphite cast irons 3:1743, 3:1759t
 sulfuric acid (H₂SO₄) effects 3:1743f
 corrosion rates 2:1196f
 corrosion removal methods 4:3321-3322
 corrosive environments
 atmospheric corrosion 3:1750, 3:1751t, 3:1752f, 3:1752t
 flow-induced corrosion
 cavitation 3:1777, 3:1777t
 erosion corrosion 3:1778, 3:1779f, 3:1780f, 3:1780t
 gaseous environments
 chlorine gas 3:1784, 3:1784t
 gaseous mixtures 3:1785t, 3:1786t
 gas transport and distribution pipes 3:1784
 high-temperature oxidation
 aluminum additive effects 3:1783f, 3:1784f
 chromium additive effects 3:1782f
 general discussion 3:1780
 heating and cooling cycle plot 3:1781f
 oxidation behaviors 3:1782f
 silicon additive effects 3:1783f
 superficial oxidation 3:1781f
 hydrogen sulfide (H₂S) 3:1783, 3:1784t
 sulfur dioxide (SO₂) 3:1783
 industrial environments
 alcohol corrosion 3:1772, 3:1773t
 alkali corrosion 3:1767, 3:1767f, 3:1768f, 3:1768t
 corrosion fatigue 3:1768, 3:1769t, 3:1770f, 3:1770t, 3:1771f, 3:1772f
 food product corrosion 3:1773, 3:1773t
 general discussion 3:1763
 glycol corrosion 3:1772, 3:1773t
 hydrochloric acid (HCl) corrosion 3:1765, 3:1765f, 3:1765t
 mineral acid corrosion 3:1766
 nitric acid (HNO₃) corrosion 3:1765, 3:1766f
 organic acid corrosion 3:1766, 3:1767t
 organic compound corrosion 3:1772
 phosphoric acid (H₃PO₄) corrosion 3:1765, 3:1766f, 3:1767t
 salt solutions 3:1768, 3:1768t, 3:1769t
 stress corrosion cracking (SCC) 3:1770, 3:1772f
 sulfuric acid (H₂SO₄) corrosion 3:1761f, 3:1762f, 3:1763, 3:1764f
 microbially-induced corrosion (MIC)
 action mechanisms 3:1775
 gelatinous vesicle development 3:1775, 3:1776f
 general discussion 3:1774
 iron-oxidizing bacteria 3:1775
 prevention strategies 3:1776
 sulfate-reducing bacteria (SRB) 3:1775
 molten materials
 liquid aluminum/aluminum alloys 3:1773
 liquid metals 3:1774
 liquid sulfur corrosion 3:1774, 3:1774t
 liquid zinc/zinc alloy corrosion 3:1774
 natural waters
 corrosion rates 3:1754, 3:1756f, 3:1756t
 dissolved oxygen effects 3:1753, 3:1755f
 galvanic corrosion 3:1756, 3:1757t
 general discussion 3:1752
 inhibitors 3:1757
 water aggressiveness and corrosiveness 3:1752, 3:1754f, 3:1754t
 nickel-resist cast irons
 acetic acid 3:1767t
 characteristics 3:1750
 corrosion rates 3:1753f, 3:1753t
 gaseous environments 3:1785t, 3:1786t
 hydrochloric acid (HCl) corrosion 3:1765t
 salt solutions 3:1768t, 3:1769t
 seawater corrosion 2:1125, 2:1125t, 3:1760f, 3:1761f, 3:1762t, 3:1761f
 protective measures 3:1762
 seawater 2:1125, 2:1125t
 corrosion rates 3:1759t, 3:1760f, 3:1760t, 3:1761f, 3:1762t, 3:1761f
 general discussion 3:1758
 gray cast iron corrosion rates 3:1759t
 sodium chloride (NaCl) concentration effects 3:1758f
 soil corrosion 3:1760, 3:1762t
 steam corrosion 3:1757
 urban/rural/marine atmospheres 3:1751t
 ductile cast iron 3:1740, 3:1740f, 3:1752t, 3:1769t
 erosion resistance 2:985f
 flow-induced corrosion
 cavitation 3:1777, 3:1777t
 erosion corrosion 3:1778, 3:1779f, 3:1780f, 3:1780t
 galvanic corrosion 2:831f, 2:849f, 2:851t, 2:982f, 2:1119f, 3:1845f
 galvanic coupling effects 3:1743, 3:1756, 3:1757t
 gaseous environments
 chlorine gas 3:1784, 3:1784t
 gaseous mixtures 3:1785t, 3:1786t
 gas transport and distribution pipes 3:1784
 high-temperature oxidation
 aluminum additive effects 3:1783f, 3:1784f
 chromium additive effects 3:1782f
 general discussion 3:1780
 heating and cooling cycle plot 3:1781f
 oxidation behaviors 3:1782f
 silicon additive effects 3:1783f
 superficial oxidation 3:1781f
 hydrogen sulfide (H₂S) 3:1783, 3:1784t
 sulfur dioxide (SO₂) 3:1783
 gray cast iron 3:1739, 3:1739f, 3:1741f, 3:1751t, 3:1756t, 3:1759t, 3:1769t, 3:1773t
 impressed current anodes 4:2782
 industrial environments
 alcohol corrosion 3:1772, 3:1773t
 alkali corrosion 3:1767, 3:1767f, 3:1768f, 3:1768t
 corrosion fatigue
 curve plots 3:1770f, 3:1771f
 fatigue resistance 3:1770t, 3:1771f, 3:1772f
 general discussion 3:1768
 limiting strengths 3:1769t
 food product corrosion 3:1773, 3:1773t
 general discussion 3:1763
 glycol corrosion 3:1772, 3:1773t
 hydrochloric acid (HCl) corrosion 3:1765, 3:1765f, 3:1765t
 mineral acid corrosion 3:1766
 nitric acid (HNO₃) corrosion 3:1765, 3:1766f
 organic acid corrosion 3:1766, 3:1767t
 organic compound corrosion 3:1772
 phosphoric acid (H₃PO₄) corrosion 3:1765, 3:1766f, 3:1767t
 salt solutions 3:1768, 3:1768t, 3:1769t
 stress corrosion cracking (SCC) 3:1770, 3:1772f
 sulfuric acid (H₂SO₄) corrosion 3:1761f, 3:1762f, 3:1763, 3:1764f
 microbially-induced corrosion (MIC)
 action mechanisms 3:1775
 gelatinous vesicle development 3:1775, 3:1776f
 general discussion 3:1774
 iron-oxidizing bacteria 3:1775
 prevention strategies 3:1776
 sulfate-reducing bacteria (SRB) 3:1775
 molten materials
 liquid aluminum/aluminum alloys 3:1773
 liquid metals 3:1774
 liquid sulfur corrosion 3:1774, 3:1774t
 liquid zinc/zinc alloy corrosion 3:1774
 marine corrosion

- cast iron (*continued*)
- corrosion rates 2:1125*t*, 3:1759*t*, 3:1760*f*, 3:1760*t*, 3:1761*f*, 3:1762*t*, 3:1761*f*
 - general discussion 2:1125, 3:1758
 - gray cast iron corrosion rates 3:1759*t*
 - sodium chloride (NaCl) concentration effects 3:1758*f*
 - microbially-induced corrosion (MIC)
 - action mechanisms 3:1775
 - gelatinous vesicle development 3:1775, 3:1776*f*
 - general discussion 3:1774
 - iron-oxidizing bacteria 3:1775
 - prevention strategies 3:1776
 - sulfate-reducing bacteria (SRB) 3:1775
 - microstructural effects 3:1741, 3:1741*f*, 3:1742*f*
 - molten materials
 - liquid aluminum/aluminum alloys 3:1773
 - liquid metals 3:1774
 - liquid sulfur corrosion 3:1774, 3:1774*t*
 - liquid zinc/zinc alloy corrosion 3:1774
 - production processes 3:1740
 - standard reduction potential 3:2074*t*
 - stress growth measurements 1:159*t*
 - sulfate-reducing bacteria (SRB) 2:1175, 2:1176*f*
 - sulfuric acid (H₂SO₄)
 - anodic polarization curves 2:1229*f*
 - anodic protection 4:2876
 - corrosion rates 2:1228, 2:1228*f*, 3:1743*f*, 3:1761*f*, 3:1763, 3:1764*f*
 - high chromium cast iron 3:1764*f*
 - iso-corrosion curve plot 3:1762*f*, 3:1764*f*
 - silicon-based cast iron 3:1764*f*
 - sulfuric acid (H₂SO₄) environments 4:3058*f*
 - unalloyed cast irons
 - alkali corrosion 3:1768*f*
 - characteristics 3:1747
 - corrosion rates 3:1760*f*, 3:1761*f*
 - gaseous environments 3:1785*t*, 3:1786*t*
 - hydrogen sulfide (H₂S) corrosion 3:1784*t*
 - natural water corrosion 3:1756*t*
 - seawater corrosion 3:1759*t*
 - vitreous enamel coatings 3:2331
 - white cast iron 3:1739, 3:1751*t*
 - cathodic blistering 4:2732
 - cathodic delamination 2:988–1004
 - basic concepts 2:989, 2:990*f*
 - delamination kinetics 2:994*f*, 2:995*f*
 - disbondment mechanisms 2:991
 - disbondment prevention 2:992
 - experimental setup schematic diagram 2:990*f*
 - general discussion 2:988
 - iron/steel surfaces 2:1001*f*, 2:1002*f*
 - marine environments 4:2685–2686
 - metal composition modifications 2:995
 - structural adhesive joints 3:2466, 3:2467*f*, 3:2468*f*
 - time-dependent effects 2:990*f*, 2:991*f*
 - cathodic modification 3:2224–2249
 - background information 3:2226
 - basic concepts
 - active-passive state 3:2227, 3:2228*f*
 - active state 3:2227, 3:2228*f*
 - general discussion 3:2227
 - passive state 3:2227, 3:2228*f*
 - transpassive state 3:2228, 3:2228*f*
 - chromium alloys 3:2241
 - chromium/chromium-based alloys
 - general discussion 3:2230
 - kinetic effects 3:2230
 - noble metal additions 3:2230
 - current research areas 3:2245
 - general discussion 3:2225, 3:2247
 - iron-40% chromium-platinum-group metals (Fe-40% Cr-PGM)
 - system 3:2243
 - noble metal additions 3:2230, 3:2241*t*
 - passivation processes 3:2225, 3:2226*f*
 - passive alloys 3:2224–2249
 - background information 3:2226
 - basic concepts
 - active-passive state 3:2227, 3:2228*f*
 - active state 3:2227, 3:2228*f*
 - general discussion 3:2227
 - passive state 3:2227, 3:2228*f*
 - transpassive state 3:2228, 3:2228*f*
 - chromium alloys 3:2241
 - chromium/chromium-based alloys
 - general discussion 3:2230
 - kinetic effects 3:2230
 - noble metal additions 3:2230
 - current research areas 3:2245
 - general discussion 3:2225, 3:2247
 - iron-40% chromium-platinum-group metals (Fe-40% Cr-PGM)
 - system 3:2243
 - noble metal additions 3:2230, 3:2241*t*
 - passivation processes 3:2225, 3:2226*f*
 - passive film growth and structure analysis 3:2242
 - process mechanisms 3:2229
 - quaternary/ternary iron-chromium (Fe-Cr) alloy systems 3:2244
 - Russian research 3:2242
 - schematic diagram 3:2227*f*
 - stainless steels
 - corrosion rates 3:2232*t*
 - duplex stainless steels 3:2237, 3:2238*t*, 3:2239*f*, 3:2241*t*
 - galvanic coupling 3:2237
 - iron-chromium (Fe-Cr) alloys 3:2231, 3:2235*f*
 - iron-chromium-molybdenum (Fe-Cr-Mo) alloys 3:2233, 3:2234*t*, 3:2241
 - iron-chromium-nickel-manganese (Fe-Cr-Ni-Mn) alloys 3:2236
 - iron-chromium-nickel-molybdenum (Fe-Cr-Ni-Mo) alloys 3:2236
 - nickel-iron-chromium (Ni-Fe-Cr) alloys 3:2235, 3:2240
 - noble metal additions 3:2231
 - surface alloying processes 3:2240, 3:2241*t*
 - surface alloying processes
 - chromium coatings 3:2239
 - electrochemical parameters 3:2241*t*
 - general discussion 3:2239
 - iron-chromium (Fe-Cr) alloys 3:2240
 - nickel-iron-chromium (Ni-Fe-Cr) alloys 3:2240
 - passive film growth and structure analysis 3:2242
 - process mechanisms 3:2229
 - quaternary/ternary iron-chromium (Fe-Cr) alloy systems 3:2244
 - Russian research 3:2242
 - schematic diagram 3:2227*f*
 - stainless steels
 - corrosion rates 3:2232*t*
 - duplex stainless steels 3:2237, 3:2238*t*, 3:2239*f*, 3:2241*t*
 - galvanic coupling 3:2237
 - iron-chromium (Fe-Cr) alloys 3:2231, 3:2235*f*
 - iron-chromium-molybdenum (Fe-Cr-Mo) alloys 3:2233, 3:2234*t*, 3:2241
 - iron-chromium-nickel-manganese (Fe-Cr-Ni-Mn) alloys 3:2236
 - iron-chromium-nickel-molybdenum (Fe-Cr-Ni-Mo) alloys 3:2236
 - nickel-iron-chromium (Ni-Fe-Cr) alloys 3:2235, 3:2240
 - noble metal additions 3:2231
 - surface alloying processes 3:2240, 3:2241*t*
 - surface alloying processes
 - chromium coatings 3:2239
 - electrochemical parameters 3:2241*t*
 - general discussion 3:2239
 - iron-chromium (Fe-Cr) alloys 3:2240
 - nickel-iron-chromium (Ni-Fe-Cr) alloys 3:2240
 - titanium alloys 3:2045, 3:2047
 - cathodic protection 4:2747–2762, 4:2801
 - application methods
 - impressed current method 4:2751, 4:2751*f*, 4:2753*t*, 4:2759
 - sacrificial anodes 4:2752, 4:2753*f*, 4:2754*t*, 4:3287, 4:3287*f*
 - background information
 - galvanic anodes
 - advantages/disadvantages 4:2806
 - characteristics 4:2804*t*
 - electrochemical reactions 4:2803
 - general discussion 4:2858
 - hybrid systems 4:2807
 - impressed current anodes
 - advantages/disadvantages 4:2806
 - characteristics 4:2804*t*
 - electrochemical reactions 4:2803

- stray-current bonding systems 4:2807, 4:2807*f*
- structures and installations 4:2802
- buried structures
 - anode backfill 4:2818
 - attenuation
 - cable materials selection 4:2821
 - coating resistance measurements 4:2821
 - drainage point measurements 4:2821, 4:2821*f*
 - field measurements 4:2820, 4:2820*f*, 4:2821*f*
 - general discussion 4:2820
 - power sources 4:2822
 - groundbed resistance
 - deep-well groundbeds 4:2819*f*, 4:2820
 - rectifier voltage determinations 4:2820
 - resistance calculations 4:2818
 - impressed current designs 4:2817, 4:2819*f*
 - soil resistivity 4:2816, 4:2816*f*
- calcareous deposits 4:2759
- coatings 4:2758, 4:2758*f*
- corrosion fatigue prevention strategies 2:950, 3:2457–2458
- current requirements 4:2757
- design guidelines
 - current requirements 4:2811, 4:2812*r*
 - economic factors 4:2811
 - electrical continuity 4:2810
 - electrolyte resistivity 4:2811
 - initial design process 4:2807, 4:2808*r*
 - surface area 4:2810
- economic factors 4:2828, 4:2830*f*
- electrochemical principles
 - aqueous corrosion 4:2748, 4:2748*f*
 - basic concepts 4:2748, 4:2749*f*, 4:2750*f*
 - hydrogen evolution 4:2750, 4:2751*f*
 - oxygen reduction 4:2749, 4:2750*f*
 - polarization diagram 4:2750*f*, 4:2751*f*
- galvanic anodes
 - advantages/disadvantages 4:2806
 - characteristics 4:2804*r*
 - design guidelines 4:2808*r*
 - electrochemical reactions 4:2803
 - research developments 4:2828
 - seawater-cooled circulating water systems 4:2822
 - ships 4:2825
- general discussion 4:2761, 4:2802, 4:2832
- historical background 4:2747
- impressed current anodes 4:2781–2800
 - advantages/disadvantages 4:2806
 - applications
 - buried structures 4:2817, 4:2819*f*
 - concrete structures 4:2798, 4:2815
 - general discussion 4:2798
 - marine/immersed structures 4:2824*f*, 4:2823, 4:2825*f*, 4:2826*f*
 - offshore installations/marine structures 4:2798
 - onshore installations 4:2798
 - seawater-cooled circulating water systems 4:2822
 - seawater-cooled condenser water boxes 4:2798
 - ships 4:2825, 4:2827*f*
 - water storage tanks 4:2826
 - background information 4:2782
 - basic concepts 4:2751, 4:2751*f*
 - carbonaceous materials
 - carbonaceous backfills 4:2789, 4:2790*r*
 - conductive overlay systems 4:2791
 - conductive paints 4:2792
 - conductive polymers 4:2791
 - graphite (C) 4:2788, 4:2789*r*
 - ceramic anodes 4:2797
 - characteristics 4:2753*r*, 4:2804*r*, 4:2811
 - design guidelines 4:2808*r*
 - electrochemical reactions 4:2803
 - ferrous materials
 - cast iron 4:2782
 - ceramic anodes 4:2785
 - ferrite anodes 4:2785
 - high silicon iron (HSI) 4:2783
 - magnetite (Fe₃O₄) anodes 4:2784
 - stainless steels 4:2783
 - steel 4:2782
- group 1 anodes
 - graphite (C) 4:2788, 4:2789*r*, 4:2813, 4:2814*r*
 - scrap steel 4:2813, 4:2814*r*
 - silicon-iron (Si-Fe) 4:2813, 4:2814*r*
- group 2 anodes
 - characteristics 4:2813
 - lead-silver (Pb-Ag) alloys 4:2814*r*, 4:2815
 - mixed metal oxide-coated titanium (MMO/Ti) anodes 4:2814*r*, 4:2815, 4:2822
 - platinized niobium anodes 4:2813, 4:2814*r*
 - platinized tantalum anodes 4:2813
 - platinized titanium anodes 4:2813, 4:2814*r*
- lead-based materials
 - lead alloys 4:2786, 4:2787*r*
 - lead dioxide (PbO₂)/mixed substrates 4:2788
 - lead-magnetite (Pb-Fe₃O₄) composites 4:2788
 - lead-platinum (Pb-Pt) bielectrodes 4:2787
 - lead-silver (Pb-Ag) alloys 4:2814*r*, 4:2815
- mixed metal oxide-coated titanium (MMO/Ti) anodes 4:2814*r*, 4:2815, 4:2822
- operating characteristics 4:2814*r*
- pipeline corrosion management 4:3288, 4:3288*f*
- platinum anodes
 - characteristics 4:2792
 - mixed metal oxide (MMO) anodes 4:2796, 4:2798
 - platinized niobium anodes 4:2795, 4:2795*r*, 4:2813, 4:2814*r*
 - platinized tantalum anodes 4:2795, 4:2795*r*, 4:2813
 - platinized titanium anodes 4:2792, 4:2795*r*, 4:2813, 4:2814*r*
- potential attenuation 4:2759, 4:2760*f*
- reinforced concrete structures 4:2815
- research developments 4:2831
- seawater-cooled circulating water systems
 - continuous anodes 4:2822
 - mixed metal oxide-coated titanium (MMO/Ti) anodes 4:2822
 - rod anodes 4:2822
 - tubular anodes 4:2822
- impressed-current systems
 - advantages/disadvantages 4:2806
 - characteristics 4:2804*r*
 - design process
 - economic factors 4:2811
 - electrical continuity 4:2810
 - initial design process 4:2807, 4:2808*r*
 - surface area 4:2810
 - electrochemical reactions 4:2803
 - seawater-cooled circulating water systems
 - automatically controlled modular systems 4:2823
 - automatic potential controlled systems 4:2823
 - general discussion 4:2823
 - manually controlled systems 4:2823
- instrumentation 4:2839–2856
 - ancillary instruments
 - attenuation measuring instruments 4:2852
 - buried metal locating instruments 4:2852
 - high-voltage coating-testing equipment 4:2850, 4:2851*f*
 - field data loggers
 - combined digital close interval potential surveys (CIPS) 4:2853, 4:2854*f*
 - current density measurement devices 4:2856
 - direct current voltage gradient (DCVG) surveys 4:2853, 4:2854*f*
 - fixed point data monitoring devices 4:2852
 - monitoring instrumentation 4:2852
 - offshore monitoring and surveying devices 4:2853, 4:2855*f*
 - pipeline cathodic protection survey devices 4:2853, 4:2854*f*
 - historical background
 - current-measuring instruments (ammeters) 4:2841, 4:2842*f*
 - potentiometers 4:2840, 4:2840*f*, 4:2841*f*
 - resistance/conductance measurement 4:2844, 4:2844*f*
 - resistivity/conductivity measurement 4:2842, 4:2843*f*
 - structure/electrolyte potential measurement 4:2841, 4:2841*f*
 - voltage/current/resistance measurement 4:2839
 - voltmeters 4:2840, 4:2840*f*, 4:2841*f*
 - recording instruments 4:2848, 4:2851*f*
 - reference electrodes 4:2846, 4:2847*r*, 4:2849*f*, 4:2849*r*, 4:2850*f*
 - routine testing instruments

- cathodic protection (*continued*)
 digital multimeters (DMMs) 4:2844, 4:2845f, 4:2845t
 measurement errors 4:2846, 4:2846f
 survey equipment 4:2852
 marine/immersed structures 4:2824f, 4:2823, 4:2825f, 4:2826f
 microbially-induced corrosion (MIC) protective strategies 2:1186
 oil and gas industry 4:3253
 organic corrosion-protective coatings 4:2646f, 4:2648, 4:2669
 pipeline corrosion management
 basic concepts 4:3287
 close interval potential surveys (CIPS) 4:3290
 design criteria 4:3288
 impressed current anodes 4:3288, 4:3288f
 internal protection 4:2812t, 4:2826, 4:2827f
 monitoring procedures 4:3289
 sacrificial anodes 4:3287, 4:3287f
 shielding criteria 4:3289
 system criteria 4:3288, 4:3289f
 potential attenuation 4:2759, 4:2760f
 protection verification
 concrete 4:2755
IR error 4:2756, 4:2757f
 metals and alloys 4:2755, 4:2755t
 potential measurements 4:2756, 4:2757f
 steel 4:2750f, 4:2751f, 4:2753, 4:2754t, 4:2755t
 reference electrodes 4:2754, 4:2754t
 research developments
 galvanic anodes 4:2828
 impressed current anodes 4:2831
 power sources
 general discussion 4:2831
 solar power 4:2832
 thermoelectric generators 4:2832
 wind power 4:2832
 seawater-cooled circulating water systems
 current requirements 4:2812t
 galvanic anodes 4:2822
 impressed current anodes
 continuous anodes 4:2822
 mixed metal oxide-coated titanium (MMO)/Ti anodes 4:2822
 rod anodes 4:2822
 tubular anodes 4:2822
 impressed-current systems
 automatically controlled modular systems 4:2823
 automatic potential controlled systems 4:2823
 general discussion 4:2823
 manually controlled systems 4:2823
 ships 4:2825, 4:2827f
 soil corrosion 2:1166
 steel-reinforced concrete structures 4:2812t, 4:2827, 4:2830f
 water storage tanks 4:2826
 zinc anodes 3:2089
 caustic soda (NaOH)
 aluminum coatings 4:2564f
 anodic protection 4:2874t
 boiler water treatment 4:2986
 characteristics 2:1191
 chemical process industry and environmental technology 3:1902, 3:1902f
 nickel-copper (Ni-Cu) alloys 3:1884
 cavitation
 characteristics 1:95t
 concrete degradation 3:2366
 corrosion management 4:3010
 corrosion test methods 2:1493, 2:1494f
 flow-induced corrosion
 cast iron 3:1777, 3:1777t
 general discussion 2:977
 pump impeller photograph 2:978f
 industrial heating and cooling systems 4:2948
 lubricant systems 2:1305
 tribocorrosion 2:1008, 2:1008f, 2:1025, 2:1026f, 2:1027f
 cellulose 2:1323, 3:2379t, 3:2442
see also wood
 cellulose nitrate 4:3331
 cement 3:2348–2368
 aluminum alloys 3:2000
 chemical properties
 cement types 3:2349
 Portland cement 3:2349, 3:2350t
 concrete
 above-water fastener selection 2:847f
 admixtures 3:2356
 aggregates 3:2355
 aluminum alloys 3:2000
 background information 3:2355
 below-water fastener selection 2:849f
 cathodic protection 4:2755, 4:2812t, 4:2827, 4:2830f
 comprehensive strength 3:2357, 3:2357t
 concreting process 3:2356
 corrosion inhibitors 4:2996
 degradation conditions
 abrasion/erosion 3:2366, 3:2366f
 acid corrosion 2:1180
 alkali-silica reaction (ASR) 3:2362, 3:2362f
 cavitation 3:2366
 conventional sulfate attacks 3:2363, 3:2363f
 cracking 3:2358
 delayed ettringite formation 3:2365
 early age thermal cracking 3:2358
 exfoliation 3:2366, 3:2366f
 fire damage 3:2367
 frost damage 3:2366, 3:2366f
 long-term drying shrinkage 3:2358, 3:2358f
 mechanical damage 3:2366
 plastic settlement cracking 3:2358, 3:2358f
 plastic shrinkage cracking 3:2358
 sulfate-induced corrosion 3:2363
 thaumasite form of sulfate attack (TSA) 3:2364
 impressed current anodes 4:2798, 4:2815
 steel-reinforced concrete structures 4:2812t, 4:2827, 4:2830f
 steel reinforcement corrosion
 carbonation 3:2359, 3:2359f
 cathodic protection 4:2755, 4:2812t, 4:2827, 4:2830f
 characteristics 3:2358
 chloride-induced corrosion 3:2359, 3:2359f
 chloride ion diffusion 3:2359
 chloride ion selective electrodes 3:2362
 chloride ion sources 3:2359
 corrosion inhibitors 4:2996
 corrosion ladder 3:2361
 diffusion cell test 3:2360
 immersion tests 3:2360
 resistivity tests 3:2360
 retrieved sample tests 3:2361
 testing errors 3:2361
 water-cement ratio 3:2357
 water (H₂O) 3:2356
 conversion process 3:2353
 degradation conditions
 alkali-silica reaction (ASR) 3:2362, 3:2362f
 cracking
 early age thermal cracking 3:2358
 general discussion 3:2358
 long-term drying shrinkage 3:2358, 3:2358f
 plastic settlement cracking 3:2358, 3:2358f
 plastic shrinkage cracking 3:2358
 mechanical damage
 abrasion/erosion 3:2366, 3:2366f
 cavitation 3:2366
 exfoliation 3:2366, 3:2366f
 fire 3:2367
 frost 3:2366, 3:2366f
 steel reinforcement corrosion
 carbonation 3:2359, 3:2359f
 cathodic protection 4:2755, 4:2812t, 4:2827, 4:2830f
 characteristics 3:2358
 chloride-induced corrosion 3:2359, 3:2359f
 chloride ion diffusion 3:2359
 chloride ion selective electrodes 3:2362
 chloride ion sources 3:2359
 corrosion inhibitors 4:2996
 corrosion ladder 3:2361
 diffusion cell test 3:2360
 immersion tests 3:2360

- resistivity tests 3:2360
- retrieved sample tests 3:2361
- testing errors 3:2361
- sulfate-induced corrosion
 - conventional sulfate attacks 3:2363, 3:2363*f*
 - delayed ettringite formation 3:2365
 - thaumasite form of sulfate attack (TSA) 3:2364
- high alumina cement (HAC) 3:2353
- Portland cement
 - chemical properties 3:2349, 3:2350*r*
 - hydration processes
 - admixed chlorides 3:2352
 - basic concepts 3:2353
 - silicates 3:2350
 - stages 3:2351
 - tetracalcium aluminoferrite (C₄AF) 3:2350*r*, 3:2351
 - tricalcium aluminate (C₃A) 3:2350*r*, 3:2351
- pozzolanic materials
 - background information 3:2354
 - ground granulated blast furnace slag (GGBS) 3:2354
 - inert fillers 3:2355
 - pulverized fuel ash (PFA) 3:2354
 - silica fume 3:2354
- cementite (Fe₃C)
 - coke filaments 1:286, 1:287*f*
 - decomposition processes 1:286–287, 1:287*f*, 1:288*f*
 - formation processes 1:285, 1:286*f*
 - graphite–cementite interface 1:287, 1:289*f*
 - mass transport model 1:287*f*
 - properties 1:275*r*
- centrifuge galvanizing 4:2568
- ceramics 1:668–690
 - advanced technical ceramics 3:2282–2305
 - alkali corrosion 2:1205
 - carbides
 - boron carbide (B₄C) 1:675
 - silicon carbide (SiC) 1:676*f*
 - corrosion resistance 1:675
 - hot corrosion 1:675, 1:676*f*
 - parabolic rate constant plot 1:677*f*
 - partial pressure effects 1:676*f*
 - penetration time–temperature plot 1:679*f*
 - sintered silicon carbides 1:677, 1:678*f*
- cement 3:2348–2368
 - chemical properties
 - cement types 3:2349
 - Portland cement 3:2349, 3:2350*r*
- concrete
 - abrasion/erosion 3:2366, 3:2366*f*
 - acid corrosion 2:1180
 - admixtures 3:2356
 - aggregates 3:2355
 - alkali–silica reaction (ASR) 3:2362, 3:2362*f*
 - background information 3:2355
 - carbonation 3:2359, 3:2359*f*
 - cavitation 3:2366
 - chloride-induced corrosion 3:2359, 3:2359*f*
 - chloride ion diffusion 3:2359
 - chloride ion selective electrodes 3:2362
 - chloride ion sources 3:2359
 - comprehensive strength 3:2357, 3:2357*r*
 - concreting process 3:2356
 - conventional sulfate attacks 3:2363, 3:2363*f*
 - corrosion ladder 3:2361
 - cracking 3:2358
 - delayed ettringite formation 3:2365
 - diffusion cell test 3:2360
 - early age thermal cracking 3:2358
 - exfoliation 3:2366, 3:2366*f*
 - fire damage 3:2367
 - frost damage 3:2366, 3:2366*f*
 - immersion tests 3:2360
 - long-term drying shrinkage 3:2358, 3:2358*f*
 - mechanical damage 3:2366
 - plastic settlement cracking 3:2358, 3:2358*f*
 - plastic shrinkage cracking 3:2358
 - resistivity tests 3:2360
 - retrieved sample tests 3:2361
 - steel reinforcement corrosion 3:2358
 - sulfate-induced corrosion 3:2363
 - testing errors 3:2361
 - thaumasite form of sulfate attack (TSA) 3:2364
 - water–cement ratio 3:2357
 - water (H₂O) 3:2356
- conversion process 3:2353
- degradation conditions
 - abrasion/erosion 3:2366, 3:2366*f*
 - alkali–silica reaction (ASR) 3:2362, 3:2362*f*
 - carbonation 3:2359, 3:2359*f*
 - cavitation 3:2366
 - chloride-induced corrosion 3:2359, 3:2359*f*
 - chloride ion diffusion 3:2359
 - chloride ion selective electrodes 3:2362
 - chloride ion sources 3:2359
 - conventional sulfate attacks 3:2363, 3:2363*f*
 - corrosion ladder 3:2361
 - cracking 3:2358
 - delayed ettringite formation 3:2365
 - diffusion cell test 3:2360
 - early age thermal cracking 3:2358
 - exfoliation 3:2366, 3:2366*f*
 - fire damage 3:2367
 - frost damage 3:2366, 3:2366*f*
 - immersion tests 3:2360
 - long-term drying shrinkage 3:2358, 3:2358*f*
 - mechanical damage 3:2366
 - plastic settlement cracking 3:2358, 3:2358*f*
 - plastic shrinkage cracking 3:2358
 - resistivity tests 3:2360
 - retrieved sample tests 3:2361
 - steel reinforcement corrosion 3:2358
 - sulfate-induced corrosion 3:2363
 - testing errors 3:2361
 - thaumasite form of sulfate attack (TSA) 3:2364
- high alumina cement (HAC) 3:2353
- hydration processes
 - admixed chlorides 3:2352
 - basic concepts 3:2353
 - silicates 3:2350
 - stages 3:2351
 - tetracalcium aluminoferrite (C₄AF) 3:2350*r*, 3:2351
 - tricalcium aluminate (C₃A) 3:2350*r*, 3:2351
- Portland cement
 - chemical properties 3:2349, 3:2350*r*
 - hydration processes 3:2350
- pozzolanic materials
 - background information 3:2354
 - ground granulated blast furnace slag (GGBS) 3:2354
 - inert fillers 3:2355
 - pulverized fuel ash (PFA) 3:2354
 - silica fume 3:2354
- ceramics–metals comparisons 1:670
- chemical dissolution
 - diffusion (blast furnace) 1:681
 - Marangoni convection (submerged entry nozzle (SEN)) 1:682, 1:682*f*
 - oxidation processes (ladle) 1:683
 - refractory materials 1:681
- corrosion behavior 1:671
- corrosion measurement 1:673
- corrosion-resistant construction materials 3:2337–2347
 - characteristics 3:2338
 - chemically resistant bricks
 - acid-resistant bricks 3:2338, 3:2338*r*
 - alumina (Al₂O₃) bricks 3:2340, 3:2340*r*
 - carbon bricks 2:1224, 2:1248, 3:2339, 3:2339*r*
 - cast basalt 3:2340, 3:2341*r*
 - foamed glass 3:2339, 3:2340*r*
 - granite 3:2340, 3:2341*r*
 - high-density fireclay 3:2339
 - porcelain bricks 3:2340
 - refractory bricks 3:2340
 - silica bricks 3:2340, 3:2340*r*
 - silicon carbide (SiC) bricks 3:2339, 3:2340*r*

- ceramics (*continued*)
- chemically resistant membranes
 - asphalt/epoxy mastic 3:2342
 - ceramic paper/potassium silicate 3:2343
 - fluorocarbons 3:2343, 3:2343*t*
 - general discussion 3:2342
 - glass fiber-reinforced resins 2:1223–1224, 3:2343
 - lead (Pb) 3:2343
 - rubber 3:2343, 3:2343*t*
 - thermoplastic materials 3:2343
 - design and construction
 - chimney lining 3:2347
 - flooring/pit/trench lining 3:2346
 - masonry linings 3:2343
 - vessel linings 3:2344
 - masonry linings
 - chemically resistant bricks 3:2338
 - design and construction 3:2343
 - mortars 3:2341
 - mortars
 - epoxy resins 3:2342, 3:2342*t*
 - furane resin 3:2341, 3:2342*t*
 - phenolic resins 3:2342, 3:2342*t*
 - polyester resins 3:2342
 - silicate-based mortars 3:2341, 3:2342*t*
 - synthetic and natural resins 3:2341, 3:2342*t*
 - vessel linings 3:2345
 - vessel linings
 - brick laying guidelines 3:2345
 - materials storage 3:2345
 - membrane application 3:2345
 - mortar preparation 3:2345
 - steel vessel fabrication 3:2344
 - surface preparation 3:2345
 - definition 1:670
 - erosion
 - blast wear (pipes) 1:684
 - flowing melts (converter) 1:684
 - refractory materials 1:681
 - general discussion 1:688
 - glass-ceramic composites 3:2306–2318
 - characteristics 3:2317
 - corrosion resistance 3:2317, 3:2318*t*
 - properties 3:2317*t*
 - impressed current anodes 4:2785, 4:2797
 - kinetic mechanisms 1:671
 - mechanical wear
 - carbon bursting (blast furnace) 1:685
 - destruction due to impact (converter) 1:686
 - refractory materials 1:681
 - thermal shock resistance (ladle) 1:685
 - metallic-ceramic coatings 4:3188, 4:3188*t*
 - nitrides
 - boron nitride (BN) 1:679, 3:2285
 - silico-carbonitrides 1:680
 - silicon nitride (SiN/Si₃N₄)
 - corrosion resistance 1:678
 - hot corrosion 1:678–679
 - penetration time-temperature plot 1:679*f*
 - oxides
 - alumina (Al₂O₃) 1:674
 - cordierite (Al₃Mg₂(Si₅AlO₁₈)) 1:674
 - general discussion 1:674
 - zirconia (ZrO₂) 1:674
 - process equipment materials 4:3210*f*, 4:3211, 4:3211*f*
 - refractory materials 1:668–690
 - chemical dissolution 1:681
 - definition 1:670
 - erosion 1:681
 - general discussion 1:681, 1:688
 - mechanical wear 1:681
 - process equipment materials 4:3210*f*, 4:3211, 4:3211*f*
 - zirconia (ZrO₂) 1:674
 - steel and slag infiltration
 - basic equations 1:686
 - slag-magnesium oxide (MgO) contact 1:687, 1:687*t*
 - steel-magnesium oxide-carbon (MgO-C) contact 1:688
 - steel-magnesium oxide (MgO) contact 1:687, 1:687*t*
 - titanium-aluminum (Ti-Al)-ceramic counterfaces 1:362, 1:365*f*
 - titanium compounds 1:680
 - ultrahigh-temperature ceramics 1:680
 - cerium (Ce)
 - alumina-forming alloys 1:608*t*, 1:609*t*, 1:628
 - chromia-forming alloys 1:608*t*, 1:609*t*
 - chromium-cerium (Cr-Ce) alloys 1:589
 - corrosion potential 2:1261, 2:1262*f*, 2:1337
 - heat-resisting alloys-carburization effects 1:284
 - ionizing radiation effects 2:1264, 2:1266*f*
 - low-alloy steel 1:569
 - magnesium alloys 3:2014–2015
 - oxidation processes 1:224
 - solid oxide fuel cells (SOFCs) 1:511–512, 1:512*f*
 - stainless steels 3:1811
 - tetragonal zirconia polycrystals (TZP) 3:2294
 - chalk 4:2995
 - chalking 4:2733
 - checking 4:2733
 - cheesiness 4:2734
 - chemical and product tankers 4:2695
 - chemical depassivation 2:774–775, 2:775*f*, 2:779, 2:780*t*
 - chemical diffusion 1:122
 - chemically resistant bricks
 - acid-resistant bricks 3:2338, 3:2338*t*
 - alumina (Al₂O₃) bricks 3:2340, 3:2340*t*
 - carbon bricks 2:1224, 2:1248, 3:2339, 3:2339*t*
 - cast basalt 3:2340, 3:2341*t*
 - foamed glass 3:2339, 3:2340*t*
 - granite 3:2340, 3:2341*t*
 - high-density fireclay 3:2339
 - porcelain bricks 3:2340
 - refractory bricks 3:2340
 - silica bricks 3:2340, 3:2340*t*
 - silicon carbide (SiC) bricks 3:2339, 3:2340*t*
 - chemically resistant membranes
 - asphalt/epoxy mastic 3:2342
 - ceramic paper/potassium silicate 3:2343
 - fluorocarbons 3:2343, 3:2343*t*
 - general discussion 3:2342
 - glass fiber-reinforced resins 2:1223–1224, 3:2343
 - lead (Pb) 3:2343
 - rubber 3:2343, 3:2343*t*
 - thermoplastic materials 3:2343
 - vessel linings 3:2345
 - chemical mechanical polishing (CMP) 2:1043, 2:1043*f*
 - chemical potential 1:5, 1:8
 - chemical thermodynamics 1:1–12
 - basic concepts
 - activity coefficient 1:6
 - chemical potential 1:5
 - entropy 1:4
 - first law of thermodynamics 1:2
 - general discussion 1:1
 - Gibbs-Duhem equation 1:6
 - Gibbs free energy 1:5, 1:8
 - second law of thermodynamics 1:3
 - terminology 1:2
 - chemical potential 1:5, 1:8
 - equilibrium activity 1:8
 - Gibbs free energy 1:5, 1:8
 - spontaneous reactions
 - basic concepts 1:7
 - reversible cells 1:7
 - standard sign conventions 1:12
 - chemical vapor deposition (CVD)
 - advanced technical ceramics 3:2299
 - aluminide coatings
 - different base-different substrate 1:665, 1:665*f*
 - simple aluminide coatings 1:663
 - uranium alloys 3:2188

- diffusion coatings 4:2535*t*, 4:2542, 4:2543*f*, 4:2544*f*, 4:2546*f*
fluidized bed techniques 4:2540, 4:2540*f*
laser chemical vapor deposition (LCVD) 4:2629, 4:2629*f*, 4:2630*f*, 4:2633*t*
magnesium alloys 3:2036
pack aluminizing process 4:2534, 4:2537*f*
silicon carbide (SiC) 3:2299
- chemolithographs 2:1179
Chilton–Colburn heat transfer expression 2:1610
chimney lining 3:2347
chlorinated butyl rubber (CIIR) 3:2436, 4:2668*t*
chlorine (Cl)
aluminum chloride (AlCl₃) 2:1086–1087, 3:1769*t*
ammonium chloride (NH₄Cl) 3:1769*t*, 4:2537*t*
anodic protection 4:2883
atmospheric conditions 2:1082*t*
beryllium (Be) corrosion 3:2170, 3:2170*f*, 3:2171*f*
calcium chloride (CaCl₂) 3:2119*t*, 4:2938–2939
cast iron corrosion 3:1784, 3:1784*t*
chlorinated organic compounds 3:2126
chlorofluorocarbons (CFCs) 2:1067*f*
chromium chloride (CrCl₂/CrCl₃) 1:328*f*, 1:403*f*, 1:479*f*
copper chloride (CuCl) 4:3315, 4:3332, 4:3333*f*
corrosive environments 1:402
ethylene dichloride (EDC) 1:403, 3:1908, 4:3221–3223, 4:3224*f*
extreme value (EV) analysis 2:1572*f*
fireside corrosion 1:477, 1:479*f*
fuel chemistry 1:459, 1:459*t*, 1:460*f*
hydrochloric acid (HCl) 2:1207–1225
acid pickling 4:2990, 4:2992*t*
alumina ceramics 3:2290, 3:2291*t*, 3:2292*f*, 3:2302*f*
aluminum alloys 3:1999*f*
aluminum coatings 4:2564*f*
amorphous alloys 3:2193, 3:2193*f*
anodic protection 4:2882, 4:2883*f*
cast iron corrosion 2:1209, 2:1209*f*, 3:1765, 3:1765*f*, 3:1765*t*
characteristics 2:1207
combustion conditions 1:461*f*
copper/copper alloys 3:1963
corrosive environments 1:402
dry deposition rates 2:1073*t*
fiber reinforced plastics (FRPs) 3:2398–2399, 3:2399*f*
flue gas composition 1:460*t*
glass linings and coatings 3:2324*t*
Henry's law coefficients for common gases 2:1056*t*
inhibitors 4:2990
iron–nickel (Fe–Ni) alloys 3:1792, 3:1792*t*
lead corrosivity 3:2063
maraging steels 3:1795
marine aerosols 2:1059, 2:1061
nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1894*f*
nickel–chromium–molybdenum (Ni–Cr–Mo) alloys 3:1888*f*
nickel/nickel alloys 2:1214*f*, 2:1215*f*, 2:1216*f*, 2:1217*f*, 2:1218*f*, 2:1220*f*
niobium corrosion 3:2144, 3:2145*f*
noble metal corrosion resistance 3:2216*t*, 3:2246
scale inhibitors/dispersants 4:2991, 4:2993*t*
stainless steels 2:1211, 2:1211*t*, 2:1212*f*, 2:1213*f*, 3:1840, 3:1840*f*
steel corrosion 2:1209, 2:1209*f*, 3:1765*t*
superheater deposit composition 1:465*f*
tantalum corrosion 3:2144, 3:2145*f*
tantalum/tantalum alloys 2:1222, 2:1223*f*
tin passivation 3:2071
titanium/titanium alloys 2:1220, 2:1221*f*
zirconium corrosivity 3:2118–2119, 3:2120*f*, 3:2121*f*, 3:2124*t*, 3:2128*t*, 3:2129*t*, 3:2130
- hypochlorous acid (HOCl) 2:1057
intermetallic alloys
hot corrosion
gaseous environments 1:661
molten salts 1:662, 1:662*f*
oxidation processes 1:659, 1:659*f*
iron chloride (FeCl₂/FeCl₃) 1:27, 1:328*f*, 1:403*f*, 1:479*f*, 2:1209, 4:3314
lead chloride (PbCl₂) 1:403*f*, 3:2060*t*
magnesium chloride (MgCl₂) 3:2119*t*, 4:2938–2939
manganese chloride (MnCl₂(H₂O)₆) 3:1769*t*
mercury chloride (HgCl₂) 1:46
metal chloride vapor pressure–temperature plot 1:403*f*
microbially-induced corrosion (MIC) 2:1187, 3:1852, 3:1852*f*, 4:2922
molten salts 1:326, 1:327*f*, 1:327*t*, 1:328*f*
molybdenum corrosion 3:2165
nickel chloride (NiCl₂) 1:329*f*, 1:403*f*, 1:479*f*
niobium corrosion 3:2144
perchloric acid (HClO₄) 3:2216*t*
pitting corrosion 2:774, 2:774*t*, 2:780*t*
polyvinyl chloride (PVC) 2:1223–1224, 2:1337
potassium chloride (KCl)
paint protection mechanisms 4:2672, 4:2673*f*, 4:2674*f*
phase diagram 1:531*f*
reference electrodes 1:46, 1:47*f*
vapor pressure–temperature plot 1:403*f*
rain chemistry 2:1063*f*, 2:1064*t*
seawater constituents 2:1109*t*
silver chloride (AgCl) 1:46, 1:48*t*, 2:1371*t*, 4:2847–2848, 4:2849*f*, 4:2849*t*, 4:2850*f*
sodium chloride (NaCl)
beryllium (Be) corrosion 3:2170, 3:2170*f*
body fluid levels 2:1311–1312, 2:1312*t*
corrosion predictions 4:3059*t*
corrosion-resistant alloys 2:1311, 2:1312*f*
marine aerosols 2:1059, 2:1061
metal–matrix composites 3:2265, 3:2265*f*
paint protection mechanisms 4:2672
phase diagram 1:531*f*
pitting corrosion 2:779*f*, 2:791*f*
superheater deposit composition 1:465*f*
vapor pressure–temperature plot 1:403*f*
water chemistry 4:2938–2939, 4:2939*t*
sodium hypochlorite (NaOCl) 3:2216*t*, 4:2968
stainless steel corrosion
environmental conditions 3:1868
high-temperature stainless steels 3:1876
ionizing radiation
basic concepts 2:1334
corrosion potential 2:1334*t*
crevice corrosion 2:1335*t*, 2:1336*f*
current flow effects 2:1336*f*
hydrogen peroxide (H₂O₂) effects 2:1335*f*
stress corrosion cracking (SCC) 3:1834, 3:1835*f*
steel reinforcement corrosion
chloride-induced corrosion 3:2359, 3:2359*f*
chloride ion diffusion 3:2359
chloride ion selective electrodes 3:2362
chloride ion sources 3:2359
stress corrosion cracking (SCC) 2:882, 2:883*f*, 2:884*f*
superheater deposit composition 1:461, 1:464*t*, 1:465*f*
tantalum corrosion 3:2144
vinyl chloride monomer (VCM) 3:1886–1887, 3:1908
wastewater treatment 3:1871
water aggressiveness and corrosiveness 3:1754*t*
wood degradation effects 3:2443–2444
zinc chloride (ZnCl₂) 1:403*f*, 2:1089*f*, 3:1769*t*
zinc chloride (ZnCl₂)–potassium chloride (KCl) mixtures
chromium chloride (CrCl₂) solubility 1:328*f*
iron chloride (FeCl₂/FeCl₃) solubility 1:328*f*
nickel chloride (NiCl₂) solubility 1:329*f*
waste incineration corrosion 1:328, 1:328*f*
zirconium corrosivity 3:2126
chlorofluorocarbons (CFCs) 2:1067*f*
chloromethane 3:2380*t*
chlorosulfonated polyethylene rubber (CSM) 3:2412*t*, 3:2416*t*, 3:2431
chromium (Cr)
age-hardenable nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
alloys 1:583–605
amorphous alloys 3:2193, 3:2197*f*, 3:2198*f*
cast refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:603*t*
cathodic modification
general discussion 3:2230
kinetic effects 3:2230
noble metal additions 3:2230
chromium–aluminum (Cr–Al) alloys 3:2198*f*
chromium–boron (Cr–B) alloys 1:589
chromium carbide precipitation 1:277*t*
chromium–carbon (Cr–C) alloys 1:589

- chromium (Cr) (*continued*)
- chromium–cerium (Cr–Ce) alloys 1:589
 - chromium–lanthanum (Cr–La) alloys 1:589
 - chromium–molybdenum (Cr–Mo) alloys 1:466*f*, 1:468*f*, 1:589
 - chromium–niobium (Cr–Nb) alloys 1:549–550, 1:550*f*, 1:589, 3:2198–2199, 3:2198*f*, 3:2199*f*, 3:2202
 - chromium–silicon (Cr–Si) alloys 1:589
 - chromium–sulfur (Cr–S) alloys 1:589
 - chromium–tantalum (Cr–Ta) alloys 3:2198–2199, 3:2198*f*, 3:2199*f*
 - chromium–titanium (Cr–Ti) alloys 1:589, 3:2198*f*, 3:2199*f*
 - chromium–yttrium (Cr–Y) alloys 1:589
 - chromium–zirconium (Cr–Zr) alloys 1:589, 3:2198–2199, 3:2198*f*, 3:2199*f*, 3:2201
 - cobalt-based alloys 3:1918, 3:1918*t*
 - cobalt–chromium–carbon (Co–Cr–C) system 3:1920
 - cobalt–chromium (CoCr) alloys 1:584, 1:586*f*, 1:593, 1:594*f*
 - cobalt–chromium–molybdenum (CoCrMo) alloy
 - corrosion fatigue 2:1318
 - corrosion resistance 2:764, 2:1314, 3:1927
 - crevice corrosion 2:1317
 - galvanic corrosion 2:1319, 3:1928
 - historical background 2:1310
 - hydrogen embrittlement 2:1317
 - pitting corrosion 2:1317
 - replacement joints 2:1046*f*, 2:1047*f*
 - zirconium (Zr)-based bulk metallic glasses 3:2200
 - cobalt–chromium–tungsten (Co–Cr–W) system 3:1920
 - compositions 1:246*t*
 - copper–nickel–chromium (Cu–Ni–Cr) alloys 3:1943
 - ferritic chromium steels
 - anodic polarization curves 2:1231*f*
 - erosion resistance 2:985*f*
 - flow-induced corrosion 2:982*f*
 - metal dusting 1:291, 1:292*f*, 1:293*f*
 - solid oxide fuel cells (SOFCs) 1:492, 1:494*t*, 1:495*f*, 1:496*f*, 1:499, 1:501*t*
 - general discussion 1:597
 - growth behavior
 - chromia (Cr₂O₃) growth 1:588
 - high temperature corrosion protection 1:587
 - spinel phase growth 1:588
 - high chromium cast iron 3:1746, 3:1748*f*, 3:1764*f*
 - high-silicon–chromium iron (Si–Cr Fe) alloys (HSCl) 4:2784
 - high temperature corrosion protection
 - alloy types 1:584
 - cobalt–chromium (Co–Cr) phase diagram 1:584, 1:586*f*
 - growth behavior 1:587
 - iron–chromium (Fe–Cr) phase diagram 1:584, 1:585*f*
 - minor element influences 1:589
 - nickel–chromium (Ni–Cr) phase diagram 1:584, 1:586*f*
 - high temperature oxidation behavior
 - austenitic stainless steels 1:591, 1:591*f*, 1:592*f*, 1:592*t*, 1:593*f*
 - calculated partial pressures 1:590*t*
 - cobalt–chromium (CoCr) alloys 1:593, 1:594*f*
 - comparison studies 1:594, 1:594*f*, 1:595*t*, 1:596*f*, 1:597*f*
 - general discussion 1:589
 - global rating parameter (KB₄) 1:594, 1:596*f*
 - martensitic and ferritic stainless steels 1:589, 1:590*t*
 - metal loss/metal penetration studies 1:595*t*, 1:596*f*, 1:597*f*
 - nickel–chromium (Ni–Cr) alloys 1:554*f*, 1:592, 1:593*t*
 - nickel–iron–chromium (Ni–Fe–Cr) alloys 1:552*f*, 1:593, 1:593*f*, 1:594*f*
 - solid oxygen fuel cell (SOFC) interconnectors 1:590*t*
 - time to breakaway 1:590*t*
 - weight gain 1:590*f*
 - historical development 1:583
 - intermetallic alloys
 - alloyed aluminide coatings 1:663, 1:664*f*
 - nickel aluminides (NiAl/Ni₃Al) 1:655–656
 - titanium aluminides (TiAl/Ti₃Al) 1:658
 - internal carbides 1:277*t*
 - iron–40% chromium–platinum-group metals (Fe–40% Cr–PGM) system 3:2243
 - iron–chromium–aluminum (Fe–Cr–Al) alloys
 - alloy grain size effects 1:616*f*
 - base metal oxide formation 1:619*f*
 - cubic alumina phases 1:620*f*, 1:621*f*
 - cycle frequency effects 1:632, 1:632*f*, 1:633*f*
 - internal oxidation 1:633, 1:634*f*
 - metal dusting 1:292
 - nitridation processes 1:639
 - parabolic rate constants 1:622*t*, 1:624*t*
 - reactive element additions 1:227*t*
 - scale adhesion 1:628*f*
 - scale growth rate 1:546*f*, 1:621, 1:622*f*, 1:623*f*
 - scale morphology 1:626, 1:627*f*
 - specimen mass gain 1:623*f*
 - sulfidation 1:552*f*, 1:638
 - sulfur impurities 1:230, 1:231*f*
 - water vapor effects 1:637
 - iron–chromium (Fe–Cr) alloys
 - breakaway oxidation mechanisms 1:428*f*, 1:430
 - carbide precipitation zones 1:278*f*
 - carburization diffusion paths 1:278*f*
 - carburization kinetics 1:277, 1:279*f*, 1:279*t*
 - carburization rate variations 1:280*f*
 - cathodic modification 3:2231
 - chromia (Cr₂O₃) scale growth mechanisms 1:419
 - chromium carbide precipitation 1:276*t*
 - compositions 1:609*t*
 - corrosion rates 3:2232*t*
 - external chromia scale formation 1:427, 1:429*f*
 - internal carbides 1:277*t*
 - internal oxidation 1:427, 1:428*f*
 - noble metal additions 3:2231, 3:2241
 - nonprotective oxidation 1:426
 - passive films 2:727, 3:2194–2195, 3:2195*t*
 - phase diagram 1:70*f*, 1:278*f*, 1:568*f*, 1:584, 1:585*f*
 - polarization curves 3:2235*f*
 - simulation techniques 2:1550*f*
 - steam and steam/hydrogen environments 1:444*f*
 - surface alloying processes 3:2240
 - iron–chromium–molybdenum (Fe–Cr–Mo) alloys 3:2233, 3:2234*t*, 3:2241
 - iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
 - iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
 - low-alloy steels 1:568, 1:568*f*
 - maximum isothermal service temperature 1:585*f*
 - metal–chromium–aluminum (MCrAl) alloys 1:613, 1:614*f*, 1:615*f*
 - nickel–chromium–aluminum (Ni–Cr–Al) alloys
 - base metal oxide formation 1:617, 1:618*f*, 1:619*f*
 - compositions 1:609*t*, 1:693*t*
 - depletion profiles 1:695*f*
 - diffusion-controlled internal nitridation 1:307*f*
 - high-temperature oxidation 1:613, 1:614*f*, 1:692, 1:693*f*
 - nitridation processes 1:639
 - oxide map 1:614*f*
 - platinum-group metal effects 1:616
 - reactive element additions 1:227*t*
 - specimen mass gain 1:619*f*
 - sulfur impurities 1:230, 1:231*f*
 - thermodynamic stability 1:308, 1:308*f*
 - nickel–chromium–aluminum–yttrium (NiCrAlY) alloys 1:615–616, 1:632*f*, 1:639
 - nickel–chromium–cobalt (Ni–Cr–Co) alloys 1:250
 - nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 - above-water fastener selection 2:847*f*
 - below-water fastener selection 2:849*f*
 - fireside corrosion 1:480*f*
 - galvanic corrosion 2:1119*f*
 - galvanic series 2:831*f*
 - general discussion 3:1886
 - hydrochloric acid (HCl) corrosion 2:1215*f*, 2:1216*f*
 - hydrofluoric acid (HF) corrosion 2:1214*f*
 - nickel–chromium (Ni–Cr) alloys
 - alumina scale formation 1:623*f*
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1209*f*
 - carburization kinetics 1:279*t*
 - carburization rate variations 1:280*f*
 - chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421*f*
 - chromium carbide precipitation 1:277*t*
 - coefficients of thermal expansion (CTEs) 1:632*f*
 - corrosion resistance 3:1885, 3:1886*f*, 3:1900
 - galvanic corrosion 2:1119*f*

- high temperature oxidation behavior 1:554*f*, 1:592, 1:593*r*
 historical development 3:1882*r*
 hydrofluoric acid (HF) corrosion 2:1214*f*
 internal carbides 1:277*r*
 internal nitridation processes 1:308–309, 1:309*f*
 major alloying elements 3:1881, 3:1881*r*
 mechanical properties 1:584
 minor alloying element addition effects 1:424*f*, 1:425*f*, 1:426*f*
 molybdenum additives 3:2159
 oxide overlay coatings 1:698*f*
 phase diagram 1:586*f*
 scale adhesion 1:627, 1:628*f*
 scaling index 1:584*r*
 steam and steam/hydrogen environments 1:430, 1:431*f*, 1:432*f*
 sulfidation corrosion 1:247*f*
 time to breakaway 1:636*f*
 vanadium attacks 1:472*f*
- nickel-iron-chromium (Ni-Fe-Cr) alloys
 carbide precipitation zones 1:281*f*
 carburization rate variations 1:280*f*
 cast refractory iron-nickel-chromium (Fe-Ni-Cr) alloys 1:603*r*
 cathodic modification 3:2235
 coke deposition 1:292*f*
 galvanic corrosion 2:831*f*, 2:851*t*, 2:852*t*, 2:1119*f*
 global rating parameter (KB₄) 1:594, 1:596*f*
 high temperature oxidation behavior 1:552*f*, 1:593, 1:593*f*, 1:594*f*
 intergranular corrosion 2:819
 intragranular corrosion 2:1478
 metal dusting 1:291, 1:292*f*, 1:293*f*
 post-carburization appearance 1:282*f*
 sulfidation corrosion 1:250
 surface alloying processes 3:2240
 wrought refractory iron-nickel-chromium (Fe-Ni-Cr) alloys 1:599*r*, 1:600*r*
- noble metal additions 3:2231, 3:2241
 oxidation processes
 carburization 1:551
 general discussion 1:211
 localized oxidation 1:212*f*
 oxidation rates 1:211, 1:212*f*
 oxide layer development 1:213, 1:213*f*, 1:215*f*
 reactive elements 1:224
 scale formation 1:182*t*, 1:183*f*, 1:213*f*
 scale morphology 1:212*f*, 1:213*f*, 1:214, 1:215*f*
 transport properties 1:211
- passivity 2:744
 quaternary/ternary iron-chromium (Fe-Cr) alloy systems 3:2244
 refractory austenitic stainless steels 1:598*r*
 refractory ferritic stainless steels 1:597*r*
 scaling index 1:584*r*
- solid oxide fuel cells (SOFCs)
 anode gas effects 1:494, 1:496*f*, 1:497*f*
 anode-side interactions 1:510, 1:511*f*, 1:512*f*
 behavior in hydrogen/water (H₂/H₂O)-based gases 1:488, 1:489*f*
 carbonaceous gas formation 1:497, 1:498*f*
 cathode-side interactions 1:507, 1:508*f*
 component thickness effects 1:502, 1:503*f*, 1:504*f*, 1:505*f*
 dual atmosphere conditions 1:507
 electronic conductivity 1:492, 1:493*f*
 equilibrium constants 1:488*f*
 ferritic chromium steels 1:492, 1:494*r*, 1:495*f*, 1:496*f*, 1:499
 gas compositions 1:497*r*
 metal-glass sealant interactions 1:512, 1:513*f*
 mixed-gas corrosion 1:489, 1:490*f*, 1:491*f*
 oxidation rates 1:490, 1:492*f*
 oxide dispersion strengthened (ODS) alloys 1:485, 1:486*f*, 1:487*f*
 oxygen partial pressure effects 1:498*f*
 scale formation 1:490*f*, 1:491*f*, 1:495*f*, 1:496*f*, 1:506*f*
 vaporization protection methods 1:509, 1:510*f*, 1:511*f*
 volatile species 1:485
- stainless steels 2:1232–1233, 2:1233*f*, 3:1809
 steam and steam/hydrogen environments
 chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421*f*
 chromia-forming iron- and nickel-based alloys 1:418, 1:420*f*
 commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422*f*, 1:423*f*
 minor alloying element addition effects 1:423, 1:424*f*, 1:425*f*, 1:426*f*
 oxidation processes 1:418
 spalling tendencies 1:419*f*
 surface morphologies 1:423*f*
 weight change comparisons 1:419*f*, 1:420*f*
 sulfidation 1:551–552, 1:552*f*
 sulfidation corrosion 1:259*f*
 wrought refractory cobalt-chromium (Co-Cr) alloys 1:602*r*
 wrought refractory iron-nickel-chromium (Fe-Ni-Cr) alloys 1:599*r*, 1:600*r*
- anodic protection 4:2874*r*
 beryllium (Be) corrosion 3:2174
 chromate conversion coatings (CCC) 3:2002, 3:2033, 4:3184, 4:3185*f*, 4:3194*r*
 chromia-forming alloys
 compositions 1:608*r*, 1:609*r*
 oxidation processes
 general discussion 1:211
 localized oxidation 1:212*f*
 oxidation rates 1:211, 1:212*f*
 oxide layer development 1:213, 1:213*f*, 1:215*f*
 reactive elements 1:224
 scale formation 1:213*f*
 scale morphology 1:212*f*, 1:213*f*, 1:214, 1:215*f*
 transport properties 1:211
- chromic acid 3:2122
 chromic acid anodizing (CAA) method 4:3184, 4:3185*f*, 4:3194*r*
 chromium anode plating 4:2587, 4:2588*r*
 chromium beryllide (CrBe₂) 3:2177
 chromium carbide
 chromium carbide (Cr₂₃C₆) 1:275*r*
 chromium carbide (Cr₇C₃) 1:275*r*
 chromium carbide (Cr₇C₃) 1:275*r*
 intergranular corrosion 2:815, 2:815*f*
 precipitation processes
 iron-chromium (Fe-Cr) alloys 1:276*r*
 nickel-chromium (Ni-Cr) alloys 1:277*r*
 properties 1:275*r*
 reaction morphologies 1:276
 thermodynamic properties 1:276
- chromium chloride (CrCl₂/CrCl₃) 1:328*f*, 1:403*f*, 1:479*f*
 chromium-modified aluminides 4:2548
 chromium nitride (CrN/Cr₂N)
 nitridation processes
 diffusion-controlled internal nitridation 1:306, 1:307*f*
 heat-resisting alloys 1:260
 iron- and nickel-based superalloys 1:310, 1:311*f*
 thermodynamic stability 1:308, 1:308*f*
- chromium oxide (Cr₂O₃)
 amorphous alloys 3:2197*f*
 diffusion processes 1:129, 1:137, 1:139*f*
 electronic conductivity 1:492, 1:493*f*
 fracture toughness values 1:168*r*
 free energy 1:542*f*
 growth behavior 1:588
 high-temperature coatings 1:693
 nitridation processes
 computer simulation modelling 1:314*f*
 general discussion 1:314
 iron- and nickel-based superalloys 1:310, 1:311*f*
 thermodynamic stability 1:308, 1:308*f*
- oxidation processes
 carburization 1:551
 general discussion 1:211
 localized oxidation 1:212*f*
 oxidation rates 1:211, 1:212*f*
 oxide layer development 1:213, 1:213*f*, 1:215*f*
 reactive elements 1:224
 scale formation 1:182*t*, 1:183*f*, 1:213*f*
 scale morphology 1:212*f*, 1:213*f*, 1:214, 1:215*f*
 transport properties 1:211
 oxidation tendencies 1:389*f*
 oxide basicity 1:477*f*
 oxide nodule formation 1:176*f*
 oxide scale growth 148, 1:413, 1:414*f*
 oxide solubility 1:476–477, 1:476*f*

- chromium (Cr) (*continued*)
- parabolic rate constant plot 1:146f, 1:147f
 - Pilling–Bedworth ratio (PBR) 1:146t, 1:160t
 - point defects 1:129
 - Poisson ratios 1:170t
 - reducing environments 1:465, 1:469f
 - scale failure strain measurements 1:167t
 - solid oxide fuel cells (SOFCs) 1:485
 - solubility plot 1:320f
 - spalling tendencies 1:144
 - steam and steam/hydrogen environments
 - chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421f
 - chromia-forming iron- and nickel-based alloys 1:418
 - commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422f, 1:423f
 - equilibrium oxygen partial pressure 1:410f
 - material testing considerations 1:413f
 - minor alloying element addition effects 1:423, 1:424f, 1:425f, 1:426f
 - oxidation processes 1:418
 - spalling tendencies 1:419f
 - surface morphologies 1:423f
 - temperature dependence effects 1:411f
 - volatile reaction products 1:409, 1:411f
 - weight change comparisons 1:419f, 1:420f
 - stress growth measurements 1:159t, 1:160f, 1:175f
 - sulfidation corrosion 1:256–257t, 1:257f, 1:258f, 1:551–552, 1:552f
 - superheater deposit composition 1:464t
 - surface fracture energies 1:170t
 - thermal expansion coefficients 1:145f
- chromium sulfate (CrSO₄) 1:477f
- coatings
- aircraft corrosion 4:3184t
 - characteristics 4:2526
 - diffusion coatings 4:2535t, 4:2536t
 - metal–chromium–aluminum–yttrium (MCrAlY) coatings
 - aluminum depletion 1:709
 - characteristics 1:696, 4:2550
 - compositions 1:696t
 - cracking 1:706, 1:707f, 1:708f
 - estimated effective fracture energies 1:709t
 - finite-element modeling predictions 1:708, 1:708f
 - gas turbines 1:537f
 - microstructure 1:697f
 - protective oxidation 1:705, 1:706f
 - spalling tendencies 1:706, 1:707f, 1:708f, 1:709t
 - steam and steam/hydrogen environments 1:449, 1:450f, 1:451f, 1:452f
 - structure 1:697f
- copper–chromium–arsenic (CCA) preservatives 2:1327, 3:2441
- corrosion potential 2:1261, 2:1263f, 2:1337
- corrosion-resistant coatings 4:2618, 4:2995, 4:2995t, 4:3184t
- crystal structure 1:55t
- electrochemical scanning tunnel microscopy (ECSTM) 2:1436
- electroplated coatings 4:2585
- galvanic corrosion 2:851t, 2:852t
- inhibitive pigments 4:2652
- ionizing radiation effects 2:1264, 2:1266f
- laser surface alloying (LSA) 4:2631
- magnesium alloys 3:2016t, 3:2019t
- nickel chromate (NiCr₂O₄) 1:182t
- nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
- alloy 20
 - corrosion resistance 3:1891
 - galvanic corrosion 2:831f, 2:1119f
 - historical development 3:1882t
 - hydrofluoric acid (HF) production 3:1907
 - major alloying elements 3:1881t
 - maximum depth of crevice attack 2:1128t
 - pitting resistance 3:1897t
 - sulfuric acid (H₂SO₄) environments 2:1238f
 - sulfuric acid (H₂SO₄) production and handling 3:1903
 - alloy 31
 - acetic acid production 3:1908
 - acrylic acid/acrylate ester production 3:1909
 - corrosion loss measurements 3:1894t, 3:1895t
 - corrosion rates 3:1905f, 3:1911f
 - corrosion resistance 3:1892, 3:1900
 - fine and specialty chemicals 3:1910
 - historical development 3:1882t
 - hydrochloric acid (HCl) isocorrosion diagram 3:1894f
 - major alloying elements 3:1881t
 - phosphoric acid (H₃PO₄) production 3:1905, 3:1906f
 - pitting potential 3:1895f
 - pitting resistance 3:1894f, 3:1897t, 3:1900, 3:1901t
 - pollution controls 3:1912
 - stability limits 3:1895f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237f, 3:1893f
 - sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904f, 3:1905f
 - tank transport studies 3:1912
- alloy 33
- alkali corrosion 2:1200f
 - caustic soda (NaOH) production 3:1902, 3:1902f
 - corrosion loss measurements 3:1896t, 3:1897t
 - corrosion resistance 3:1892, 3:1896f
 - historical development 3:1882t
 - major alloying elements 3:1881t
 - pitting resistance 3:1894f, 3:1897t
 - sulfuric acid (H₂SO₄) environments 2:1238f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897f
 - sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 825
- alkali corrosion 2:1200f
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - hydrohalic acid corrosion 2:1217f, 2:1219f
 - major alloying elements 3:1881t
 - nuclear waste isolation 2:767
 - pitting resistance 3:1897t
 - sulfuric acid (H₂SO₄) environments 2:1238f, 2:1243f
 - sulfuric acid (H₂SO₄) production and handling 3:1903
 - vinyl chloride monomer (VCM) production 3:1908
- alloy G-3
- acrylic acid/acrylate ester production 3:1909
 - corrosion loss measurements 3:1894t
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - hydrofluoric acid (HF) production 3:1907
 - major alloying elements 3:1881t
- alloy G-30
- corrosion loss measurements 3:1896t
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - major alloying elements 3:1881t
 - sulfuric acid (H₂SO₄) environments 2:1238f
- corrosion resistance 3:1891
- historical development 3:1882t
 - laser surface alloying (LSA) 4:2631
 - major alloying elements 3:1881, 3:1881t
- nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
- above-water fastener selection 2:847f
 - alloy 22
 - corrosion loss diagram 3:1888f
 - corrosion resistance 3:1887
 - hydrohalic acid corrosion 2:1217f, 2:1219f, 2:1220f
 - major alloying elements 3:1881t
 - nuclear waste isolation 2:767
 - thermal stability 3:1890t
 - time–temperature–sensitization diagram 3:1891f
- alloy 59
- acetic acid production 3:1908
 - corrosion loss diagram 3:1888f
 - corrosion rates 3:1889f, 3:1905f, 3:1911f
 - corrosion resistance 3:1887, 3:1900
 - fine and specialty chemicals 3:1910
 - hydrochloric acid (HCl) isocorrosion diagram 3:1888f
 - hydrofluoric acid (HF) production 3:1907
 - hydrohalic acid corrosion 2:1217f, 2:1219f
 - major alloying elements 3:1881t
 - methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 - phosphoric acid (H₃PO₄) production 3:1906f
 - pitting resistance 3:1894f
 - pollution controls 3:1912
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1888f

- sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904f, 3:1905f
- tank transport studies 3:1912
- thermal stability 3:1890t, 3:1891f
- time-temperature-sensitization diagram 3:1891f
- toluene di-isocyanate (TDI) 3:1909
- vinyl chloride monomer (VCM) production 3:1908
- alloy 625
- acrylic acid/acrylate ester production 3:1909
- alkali corrosion 2:1200f
- corrosion loss diagram 3:1888f
- corrosion rates 3:1889f
- corrosion resistance 3:1890, 3:1899
- galvanic corrosion 2:849f
- hydrohalic acid corrosion 2:1217f, 2:1219f
- major alloying elements 3:1881t
- nuclear waste isolation 2:767
- phosphoric acid (H₃PO₄) production 3:1905
- pitting resistance 3:1894f, 3:1900
- sulfuric acid (H₂SO₄) isocorrosion diagram 2:1243f
- thermal expansion coefficients 1:145f
- time-temperature-sensitization diagram 3:1891f
- vinyl chloride monomer (VCM) production 3:1908
- alloy 686
- corrosion resistance 3:1889
- hydrohalic acid corrosion 2:1217f, 2:1219f
- major alloying elements 3:1881t
- thermal stability 3:1890t, 3:1891f
- time-temperature-sensitization diagram 3:1891f
- alloy 2000
- corrosion resistance 3:1889
- hydrohalic acid corrosion 2:1218f, 2:1219f, 2:1220f
- major alloying elements 3:1881t
- sulfuric acid (H₂SO₄) environments 2:1241f, 2:1247f
- thermal stability 3:1890t, 3:1891f
- time-temperature-sensitization diagram 3:1891f
- alloy C-4
- corrosion loss diagram 3:1888f
- corrosion resistance 3:1887, 3:1900
- hydrohalic acid corrosion 2:1220f
- major alloying elements 3:1881t
- methylene di-*para*-phenylene isocyanate (MDI) 3:1909
- thermal expansion coefficients 1:145f
- time-temperature-sensitization diagram 3:1891f
- toluene di-isocyanate (TDI) 3:1909
- alloy C-276
- acetic acid production 3:1908
- acrylic acid/acrylate ester production 3:1909
- corrosion loss diagram 3:1888f
- corrosion rates 3:1889f
- corrosion resistance 3:1886, 3:1900
- galvanic corrosion 2:849f
- hydrofluoric acid (HF) production 3:1907
- hydrohalic acid corrosion 2:1217f, 2:1219f, 2:1220f
- major alloying elements 3:1881t
- methylene di-*para*-phenylene isocyanate (MDI) 3:1909
- phosphoric acid (H₃PO₄) production 3:1906f
- pitting resistance 3:1894f, 3:1900
- pollution controls 3:1912
- styrene production 3:1908
- sulfuric acid (H₂SO₄) environments 2:1238f, 2:1240f, 2:1243f
- sulfuric acid (H₂SO₄) isocorrosion diagram 3:1887f
- sulfuric acid (H₂SO₄) production and handling 3:1903
- thermal expansion coefficients 1:145f
- thermal stability 3:1890t
- time-temperature-sensitization diagram 3:1891f
- toluene di-isocyanate (TDI) 3:1909
- vinyl chloride monomer (VCM) production 3:1908
- alloy MAT 21 3:1881t, 3:1889
- below-water fastener selection 2:849f
- fireside corrosion 1:480f
- flow-induced corrosion 2:982f
- general discussion 3:1886
- historical development 3:1882t
- hydrochloric acid (HCl) corrosion 2:1215f, 2:1216f
- hydrofluoric acid (HF) corrosion 2:1214f
- intergranular corrosion 2:819
- major alloying elements 3:1881, 3:1881t
- materials selection 2:982f
- nitric acid (HNO₃) solutions 2:1252, 2:1252t
- nitridation processes 1:400
- soluble pigments 4:2670
- stainless steels
- alloying influences 2:1232-1233, 2:1233f, 3:1809
- grades
- chemical compositions 3:1810t, 3:1812t, 3:1825t, 3:1863t, 3:1874t
- seawater corrosion 3:1856t
- testing environments 3:1864t
- strontium chromate (SrCrO₄) 2:993, 2:994f
- surgical implants
- cobalt-chromium-molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
- environmental conditions 2:1311, 2:1312f
- health effects 2:1310, 2:1310t
- historical background 2:1308
- zirconium corrosivity 3:2122
- Cihal's test 2:825t, 2:826
- cinders 3:2087t, 4:2563t
- cissing 4:2734
- citric acid 3:1766, 3:1842, 3:2073, 4:2882, 4:2990, 4:2994
- cladding 4:2521
- Cladosporium resiniae* 2:1181, 4:3178
- clay 2:1154, 2:1155f, 3:2087t, 3:2331t, 4:2563t, 4:2943, 4:2995
- CLIMAT test 2:846f, 2:847
- closed-loop water systems 4:2943
- coal
- coal plant ammonia absorber system 4:3140, 4:3141f
- flue gas composition 1:460t
- fuel chemistry 1:459, 1:459t, 1:460f
- high-temperature corrosion 1:475f
- superheater deposit composition 1:464t, 1:465f
- coal-derived bricks 2:1248, 3:2339, 3:2339t
- coal-fired boiler corrosion 1:404, 4:3140, 4:3142f, 4:3143f
- coal gasification 1:273
- coal tar
- coal tar and asphalt/bitumen enamels 4:2709, 4:2812t, 4:3283, 4:3283t
- epoxy coatings 4:2668t, 4:2694t, 4:2705, 4:2706f
- preservative treatments 2:1327
- coatings
- acrylic coatings 4:3328
- aluminum alloys
- anodized coatings 3:2005, 3:2006f
- conversion coatings 3:2002
- gas turbines 1:537f
- organic coatings 3:2006
- titanium-aluminum (Ti-Al) alloys 1:697
- aluminum pigmented coatings 4:2694t
- anodic oxide films 4:2503-2518
- aircraft corrosion 4:3184t
- anodizing procedures 4:2504, 4:2504t
- color anodizing processes 4:2505, 4:2505t
- corrosion resistance
- atmospheric exposure 4:2513t, 4:2516
- general discussion 4:2516
- maintenance factors 4:2513
- research developments 4:2516
- magnesium alloys 3:2034, 3:2035f, 3:2035t, 3:2036f
- porous oxide formation mechanisms
- cross-section diagram 4:2507f
- general discussion 4:2505
- pore quantity 4:2506t
- research developments 4:2515-2516
- TEM cross-section image 4:2507f, 4:2510f, 4:2516f
- unit barrier-layer thickness 4:2506t
- properties
- breakdown voltage 4:2509
- composition 4:2507
- density 4:2508, 4:2508f
- dielectric constant 4:2509
- effect on mechanical properties 4:2514
- emissivity 4:2510t, 4:2511

- coatings (*continued*)
- flexibility 4:2508
 - friction 4:2514
 - hardness 4:2508
 - heat conduction 4:2510
 - heat reflectivity 4:2509*f*, 4:2511
 - heat resistance 4:2511
 - reflectivity 4:2511*t*, 4:2513
 - refractive index 4:2513
 - research developments 4:2516
 - resistance 4:2509
 - thermal expansion 4:2510
 - thickness measurements 4:2511*t*, 4:2515
 - research developments
 - anodizing procedures 4:2514–2515
 - color anodizing processes 4:2514
 - corrosion resistance 4:2516
 - porous oxide formation mechanisms 4:2515–2516
 - properties 4:2516
 - antichip coatings 4:3173
 - antifouling coatings 2:1143, 4:2691, 4:2692*t*, 4:2949
 - automotive industry
 - antichip coatings 4:3173
 - anticorrosive waxes 4:3173
 - general discussion 4:3171
 - pretreatment guidelines 4:3171
 - primers 4:3172
 - seam sealants 4:3173
 - surfacers 4:3173
 - underbody protection 4:3173
 - barrier coatings 1:509, 1:510*f*, 1:511*f*, 2:949
 - biocidal coatings 2:1187, 4:2691–2692, 4:2692*t*, 4:2949
 - carbon materials 3:2279
 - cathodic protection 4:2758, 4:2758*f*
 - cellulose nitrate 4:3331
 - chromate conversion coatings (CCC) 3:2002, 3:2033, 4:3184, 4:3185*f*, 4:3194*t*
 - cladding 4:2521
 - controlled depletion polymers (CDPs) 4:2691–2692, 4:2692*t*
 - corrosion fatigue 2:949
 - corrosion prevention strategies 3:2033
 - corrosion-resistant alloys 2:1316, 4:2618, 4:3184*t*
 - deposition techniques
 - nonthermal spraying
 - air spraying 4:2610
 - electrostatic spray deposition (ESD) 4:2611, 4:2640
 - sprayed coatings 4:2610–2621
 - air-assisted airless spray application 4:2640
 - airless spray application 4:2639
 - air spraying 4:2638
 - cold-gas dynamic spraying (CGDS) 4:2612*t*, 4:2616
 - corrosion-resistant coatings 4:2618
 - detonation gun spraying (D-Gun) 4:2612*t*, 4:2616
 - electrostatic spray application 4:2640
 - flame spraying 4:2612, 4:2612*t*
 - heated spray application 4:2640
 - high-pressure plasma spraying (HPPS) 4:2615
 - high-velocity oxy-fuel (HVOF)/high-velocity air fuel (HVOF) spraying 4:2612*t*, 4:2615, 4:2626
 - high-velocity suspension flame spraying (HVSFS) 4:2613
 - inert plasma spraying (IPS) 4:2615
 - inorganic sprayed coatings applications 4:2620
 - laser-hybrid techniques 4:2617, 4:2627, 4:2633*t*
 - laser surface melting/remelting (LSM) 4:2626, 4:2633*t*
 - liquid feedstock 4:2617
 - low-pressure plasma spraying (LPPS) 4:2615
 - metallic coatings 4:2521
 - metallic coatings applications 4:2618, 4:2626
 - metallic glass coatings 4:2617
 - metal matrix composite (MMC) coatings 4:2626–2627
 - nanostructured coatings 4:2617
 - nonthermal spraying 4:2610
 - plasma spraying 4:2612*t*, 4:2614
 - plasma-transferred arc (PTA) spraying 4:2615
 - processing techniques 4:2618
 - radio frequency (RF) induction plasma spraying 4:2615
 - reactive flame spraying (RFS) 4:2613
 - shrouded plasma spraying (SPS) 4:2614–2615
 - supersonic RF plasma spraying 4:2615
 - thermal spraying 3:2036, 4:2611
 - tin coatings 3:2074
 - vacuum plasma spraying (VPS) 4:2615
 - wire arc spraying 4:2612*t*, 4:2613
 - thermal spraying
 - basic concepts 4:2611
 - cold-gas dynamic spraying (CGDS) 4:2612*t*, 4:2616
 - detonation gun spraying (D-Gun) 4:2612*t*, 4:2616
 - flame spraying 4:2612, 4:2612*t*
 - high-pressure plasma spraying (HPPS) 4:2615
 - high-velocity oxy-fuel (HVOF)/high-velocity air fuel (HVOF) spraying 4:2612*t*, 4:2615, 4:2626
 - high-velocity suspension flame spraying (HVSFS) 4:2613
 - inert plasma spraying (IPS) 4:2615
 - laser-hybrid techniques 4:2617, 4:2627, 4:2633*t*
 - laser surface melting/remelting (LSM) 4:2626, 4:2633*t*
 - liquid feedstock 4:2617
 - low-pressure plasma spraying (LPPS) 4:2615
 - magnesium alloys 3:2036
 - metallic glass coatings 4:2617
 - metal matrix composite (MMC) coatings 4:2626–2627
 - nanostructured coatings 4:2617
 - plasma spraying 4:2612*t*, 4:2614
 - plasma-transferred arc (PTA) spraying 4:2615
 - postprocessing techniques 4:2618
 - preprocessing processing techniques 4:2618
 - radio frequency (RF) induction plasma spraying 4:2615
 - reactive flame spraying (RFS) 4:2613
 - shrouded plasma spraying (SPS) 4:2614–2615
 - supersonic RF plasma spraying 4:2615
 - vacuum plasma spraying (VPS) 4:2615
 - wire arc spraying 4:2612*t*, 4:2613
 - design-based mitigation 4:3079*f*
 - diffusion coatings 4:2532–2555
 - aluminide coatings 1:701, 1:701*f*
 - background information 4:2532
 - basic characteristics 1:700
 - fluidized bed techniques 4:2535*t*, 4:2540, 4:2540*f*, 4:2641
 - gas and vapor phase chemical vapor deposition techniques 4:2535*t*, 4:2542, 4:2543*f*, 4:2544*f*, 4:2546*f*
 - general discussion 4:2552
 - metallizing process 4:2535*t*, 4:2541
 - modified aluminide coatings
 - background information 4:2543
 - bulk chemical analysis data 4:2548*t*
 - chromium-modified aluminides 4:2548
 - cyclic oxidation lifetimes 4:2549*f*
 - cyclic oxidation performance 4:2551*f*
 - fabrication processes 4:2544
 - impurity effects 4:2546, 4:2548*t*
 - platinum aluminide coatings 4:2544, 4:2545*f*, 4:2546*f*, 4:2547*f*, 4:2549*f*
 - reactive element-modified aluminides 4:2549, 4:2550*f*
 - silicon-modified aluminides 4:2548, 4:2549*f*
 - yttrium-modified aluminides 4:2550*f*
 - molten salt baths 4:2535*t*, 4:2541
 - pack cementation process
 - aluminizing process 4:2534, 4:2537*f*, 4:2538*f*
 - basic concepts 4:2534
 - characteristics 4:2535*t*
 - deposition temperatures 4:2536*t*
 - facility diagram 4:2536*f*
 - inward growth diffusion coatings 4:2537, 4:2539*f*
 - outward grown diffusion coatings 4:2538, 4:2539*f*
 - pack compositions 4:2536*t*, 4:2537*t*
 - platinized coatings 1:702
 - process routes 4:2535*t*
 - Sermaloy J 4:2540*f*, 4:2548–2549, 4:2549*f*
 - silicide diffusion coatings 1:702, 1:703*f*
 - slurry cementation process 4:2535*t*, 4:2538, 4:2540*f*
 - substrate alloy interdiffusion mitigation
 - background information 4:2550
 - metal–chromium–aluminum–yttrium (MCrAlY) coatings 4:2550
 - SMARTCOAT concept 4:2551, 4:2552*f*, 4:2553*f*

- electrodeposited coatings 4:2521
- epoxy-amine coatings
- aircraft corrosion 4:3184*r*, 4:3188, 4:3189*f*, 4:3194*r*
 - ballast tanks 4:2694*r*
 - buried and ground-contact structures 4:2705, 4:2706*f*
 - cargo holds 4:2697*r*
 - characteristics 4:2695*r*
 - external decks 4:2698*r*
 - field joint coatings 4:2711
 - topsides and superstructures 4:2699*r*
- failures and defects 4:2728–2745
- adhesion failure 4:2730
 - alligatoring 4:2730
 - aluminum corrosion 4:2731
 - brittiness 4:2731
 - bleaching 4:2731
 - bleeding/bleed through 4:2731
 - blistering 4:2731, 4:2732
 - bloom/blush 4:2732
 - bridging 4:2732
 - brush marks 4:2733
 - bubbles/bubbling 4:2733
 - cathodic delamination 2:988–1004
 - basic concepts 2:989, 2:990*f*
 - delamination kinetics 2:994*f*, 2:995*f*
 - disbondment mechanisms 2:991
 - disbondment prevention 2:992
 - experimental setup schematic diagram 2:990*f*
 - general discussion 2:988
 - iron/steel surfaces 2:1001*f*, 2:1002*f*
 - marine environments 4:2685–2686
 - metal composition modifications 2:995
 - time-dependent effects 2:990*f*, 2:991*f*
 - causal factors 4:2729
 - chalking 4:2733
 - checking 4:2733
 - cheesiness 4:2734
 - cissing 4:2734
 - cobwebbing 4:2734
 - cracking 4:2734
 - cratering 4:2735
 - crawling 4:2734
 - crocodiling 4:2730
 - crowsfooting 4:2735
 - delamination 4:2730, 4:2735
 - dryspray 4:2736
 - efflorescence 4:2736
 - erosion 4:2736
 - fading 4:2736
 - filiform corrosion 2:988–1004
 - aluminum alloys 2:996*f*, 2:999, 2:999*f*, 2:1000*f*, 3:1990
 - aluminum surfaces 2:996*f*, 2:997
 - background information 2:996
 - characteristics 2:996, 4:2737
 - general discussion 2:988
 - iron/steel surfaces 2:1000, 2:1001*f*, 2:1002*f*
 - propagation mechanisms 2:997, 2:997*f*
 - surface-active filiform corrosion 2:999, 2:999*f*, 2:1000*f*
 - flaking 4:2730, 4:2737
 - flocculation 4:2737
 - flooding 4:2737
 - flotation 4:2738
 - grinning/grinning through 4:2738
 - grit inclusions 4:2738
 - growths and attachments 4:2738
 - impact damage 4:2739
 - incorrect coating systems 4:2739
 - ladders/laddering 4:2733
 - lamination 4:2739
 - misses/skips/holidays 4:2739
 - mud cracking 4:2739
 - orange peel/pock marks 4:2740
 - overspray 4:2740
 - peeling 4:2740
 - pinholes 4:2741
 - rain damage/water spotting 4:2741, 4:2744
 - rippled coating 4:2741
 - rivelling 4:2744
 - ropiness 4:2733
 - runs/sags/curtains 4:2741
 - rust rashing 4:2742
 - rust spotting 4:2742
 - rust staining 4:2742
 - saponification 4:2743
 - settlement 4:2743
 - shelling 4:2739
 - solvent lifting 4:2743
 - solvent popping 4:2743
 - star cracking 4:2739
 - tackiness 4:2743
 - undercutting 4:2744
 - water spotting 4:2744
 - wrinkling 4:2735, 4:2741, 4:2744
 - zinc carbonates 4:2745
- field joint coatings 4:2711, 4:2711*f*, 4:3284
- foul release coatings 4:2692, 4:2692*r*
- gas turbines 1:523–524, 1:525*r*
- glass linings and coatings 3:2319–2329
- advantages/disadvantages 3:2319
 - damage monitoring and analysis
 - in-situ* sensing technology 3:2327
 - repair techniques 3:2328
 - research developments 3:2328
 - glass enamel corrosion
 - acid environments 3:2326
 - alkaline environments 3:2326
 - complex formation 3:2326
 - fluoride formation 3:2326
 - general discussion 3:2325
 - mineral acids 3:2326
 - organic acids 3:2326
 - water environments 3:2325
 - glass-lined steel equipment manufacturing processes
 - certifications and standards 3:2322, 3:2322*r*, 3:2323*r*
 - glass formulations 3:2319, 3:2321*f*, 3:2321*r*
 - glass preparation 3:2321
 - lining process 3:2323
 - metal preparation 3:2322
 - glass-on-steel properties
 - chemical corrosive environments 3:2324*r*
 - chemical properties 3:2324
 - corrosion inhibition 3:2327
 - durability 3:2324*r*
 - glass enamel corrosion 3:2325
 - in-service enamel behavior 3:2325
 - mechanical properties 3:2323
 - surface properties 3:2325
 - temperature-dependent leaching 3:2327
 - testing methods 3:2324, 3:2325*r*
 - thermal properties 3:2323
- heat shrinkable materials 4:3283, 4:3283*r*
- high-temperature coatings 1:691–724
- coating types
 - diffusion coatings 1:700
 - overlay coatings 1:696, 1:696*r*
 - SMART* MCrAlY overlay coatings 1:699, 1:699*f*, 1:700*f*
 - thermal barrier coatings 1:704, 1:704*f*, 1:705*f*, 1:712
 - diffusion coatings
 - aluminide coatings 1:701, 1:701*f*
 - basic characteristics 1:700
 - platinized coatings 1:702
 - silicide diffusion coatings 1:702, 1:703*f*
 - importance 1:692
 - metal-chromium-aluminum-yttrium (MCrAlY) coatings
 - aluminum depletion 1:709
 - characteristics 1:696
 - compositions 1:696*r*
 - cracking 1:706, 1:707*f*, 1:708*f*
 - estimated effective fracture energies 1:709*r*
 - finite-element modeling predictions 1:708, 1:708*f*
 - gas turbines 1:537*f*
 - microstructure 1:697*f*
 - protective oxidation 1:705, 1:706*f*

- coatings (*continued*)
- spalling tendencies 1:706, 1:707*f*, 1:708*f*, 1:709*t*
 - structure 1:697*f*
 - nickel-based superalloys 1:692, 1:693*f*, 1:693*t*
 - overlay coatings
 - metal–chromium–aluminum–yttrium (MCrAlY) coatings 1:696, 1:696*t*, 1:697*f*, 1:705, 1:706*f*, 4:2550
 - oxide overlay coatings 1:698, 1:698*f*
 - titanium–aluminum (Ti–Al) alloys 1:697
 - protective oxidation
 - alumina (Al₂O₃) layers 1:705, 1:706*f*
 - aluminum depletion 1:709
 - cracking 1:706, 1:707*f*, 1:708*f*
 - estimated effective fracture energies 1:709*t*
 - finite-element modeling predictions 1:708, 1:708*f*
 - metal–chromium–aluminum–yttrium (MCrAlY) coatings 1:705, 1:706*f*
 - spalling tendencies 1:706, 1:707*f*, 1:708*f*, 1:709*t*
 - requirements
 - coating composition 1:694
 - depletion profiles 1:695*f*
 - protective oxide layer 1:693
 - solute supply 1:694
 - SMART MCrAlY overlay coatings 1:699, 1:699*f*, 1:700*f*
 - thermal barrier coatings
 - aeroengine applications 1:704*f*
 - characteristics 1:704
 - chemical failures 1:719, 1:720*f*
 - cross-section diagram 1:705*f*
 - failure characteristics 1:713, 1:714*f*, 1:715*f*, 1:716*f*
 - martensite formation 1:717
 - mechanical instabilities 1:716*f*, 1:717
 - oxidation-induced failure 1:712
 - schematic cross-section diagram 1:705*f*
 - strain energy 1:715
 - subcritical crack growth 1:716, 1:721*f*
 - surface roughness 1:718, 1:719*f*, 1:720, 1:720*f*, 1:721*f*
 - time-to-failure data plot 1:713*f*
 - topcoat cracking 1:716*f*, 1:721*f*
 - transformation strains 1:716
 - hot-dipped coatings 4:2556–2576
 - aluminum coatings 4:2564
 - applications 4:2572, 4:2573*t*
 - basic concepts 4:2556
 - dipping process
 - basic concepts 4:2565
 - cleaning 4:2565
 - dipping 4:2566
 - operating principles 4:2565
 - post-treatment 4:2566
 - practicabilities 4:2521
 - duplex coatings 4:2572
 - future developments 4:2573
 - hot dip aluminization 4:2572
 - hot dip galvanizing
 - degreasing methods 4:2567, 4:2567*f*
 - design guidelines 4:2566
 - duplex coatings 4:2572
 - fluxing operations 4:2567, 4:2567*f*
 - galvanizing process 4:2568, 4:2568*f*, 4:2569*f*
 - general discussion 4:2566
 - organic systems 4:2572
 - pickling methods 4:2567, 4:2567*f*
 - post-galvanizing treatments 4:2570
 - hot tinning 4:2571
 - metallic coatings 4:2521
 - organic systems 4:2572
 - standards
 - ASTM standards 4:2574*t*
 - EN/ISO standards 4:2573*t*
 - general discussion 4:2573
 - terne coatings 4:2565, 4:2571
 - tin coatings
 - basic concepts 4:2556
 - corrosion behavior 4:2564
 - general discussion 3:2074
 - hot tinning 4:2571
 - zinc coatings
 - alloying additions 4:2569
 - atmospheric corrosion 4:2558, 4:2559*t*, 4:2560*t*
 - continuous zinc/zinc alloy coatings 4:2570
 - corrosion behavior 4:2557, 4:2557*f*, 4:2558*f*
 - detergents 4:2562
 - inorganic chemicals 4:2562–2563
 - lubricants 4:2563
 - organic chemicals 4:2563
 - soil corrosion 4:2562, 4:2563*t*
 - steel 4:2563
 - water corrosion 4:2562, 4:2562*t*
 - white rust 4:2563–2564
 - zinc–aluminum (Zn–Al) alloy coatings 4:2557*f*, 4:2558, 4:2558*f*
 - zinc–iron (Zn–Fe) alloys 4:2558
 - intermetallic alloys
 - aluminide coatings
 - alloyed aluminide coatings 1:663, 1:664*f*, 1:665*f*
 - different base–different substrate 1:665, 1:665*f*
 - same base–same substrate 1:663
 - simple aluminide coatings 1:663
 - uranium alloys 3:2188
 - general discussion 1:662
 - laser cladding (LC) 4:2624, 4:2633*t*
 - thermal barrier coatings 1:664–665
 - aeroengine applications 1:704*f*
 - characteristics 1:704
 - chemical failures 1:719, 1:720*f*
 - cross-section diagram 1:705*f*
 - failure characteristics 1:713, 1:714*f*, 1:715*f*, 1:716*f*
 - martensite formation 1:717
 - mechanical instabilities 1:716*f*, 1:717
 - oxidation-induced failure 1:712
 - schematic cross-section diagram 1:705*f*
 - strain energy 1:715
 - subcritical crack growth 1:716, 1:721*f*
 - surface roughness 1:718, 1:719*f*, 1:720, 1:720*f*, 1:721*f*
 - time-to-failure data plot 1:713*f*
 - topcoat cracking 1:716*f*, 1:721*f*
 - transformation strains 1:716
 - titanium aluminides (TiAl/Ti₃Al) 1:665
 - laser-applied coatings
 - advantages 4:2633
 - general discussion 4:2624
 - high-velocity oxy-fuel (HVOF)/high-velocity air fuel (HVAf) spraying 4:2626
 - laser chemical vapor deposition (LCVD) 4:2629, 4:2629*f*, 4:2630*f*, 4:2633*t*
 - laser cladding (LC) 4:2624, 4:2625*f*, 4:2633*t*
 - laser gas nitriding (LGS) 4:2632, 4:2632*f*, 4:2633*t*
 - laser-hybrid sprayed coating techniques 4:2617, 4:2627, 4:2633*t*
 - laser melt/particle injection (LMI) 4:2628
 - laser surface alloying (LSA) 4:2630, 4:2632*f*, 4:2633*t*
 - laser surface melting/remelting (LSM) 4:2626, 4:2633*t*
 - limitations 4:2633
 - magnesium alloys 3:2036
 - metal matrix composite (MMC) coatings 4:2626–2627
 - pulsed laser deposition (PLD) 4:2628, 4:2628*f*, 4:2633*t*
 - low solar absorption (LSA) coatings 4:2699
 - magnesium alloys
 - anodic films 3:2034, 3:2035*f*, 3:2035*t*, 3:2036*f*
 - chemical vapor deposition (CVD) 3:2036
 - chromate conversion coatings (CCC) 3:2033
 - coating systems and design 3:2037
 - corrosion prevention strategies 3:2033
 - electrochemical conversion coatings 3:2034, 3:2035*f*, 3:2035*t*, 3:2036*f*
 - electro/electroless deposition 3:2034, 3:2036*f*
 - electron beam deposition techniques 3:2036
 - laser-applied coatings 3:2036
 - organic coatings 3:2036
 - thermal spraying 3:2036
 - marine coatings 4:2683–2701
 - coating processes
 - maintenance and repair 4:2690
 - Newbuilding shipyard 4:2689
 - coating selection criteria
 - ballast tanks 4:2692, 4:2693*f*, 4:2694*t*

- cargo holds 4:2696, 4:2697f, 4:2697t
- cargo tanks 4:2694
- chemical and product tankers 4:2695
- coating types and schemes 4:2695t
- external decks 4:2698, 4:2698t
- general discussion 4:2698
- topsides and superstructures 4:2699, 4:2699t
- underwater hulls 4:2691, 4:2692t
- vessel interiors 4:2699
- corrosion breakdown
 - abrasive blasting standards 4:2687t
 - ballast tanks 4:2692, 4:2693f, 4:2694t
 - blistering 4:2685–2686
 - cargo holds 4:2696, 4:2697f, 4:2697t
 - cargo tanks 4:2694
 - cathodic disbonding 4:2685–2686
 - chemical and product tankers 4:2695
 - cracking 4:2686f, 4:2686
 - edge coatings 4:2688f, 4:2688
 - general discussion 4:2685
 - rust jacking 4:2686f, 4:2685–2686
 - surface preparation 4:2687–2688
 - underwater hulls 4:2692
- future trends 4:2699
- marine vessels
 - ballast tanks 4:2684f, 4:2684t, 4:2692, 4:2693f, 4:2694t
 - general discussion 4:2683
 - ship characteristics 4:2684f
 - ship types 4:2684t
 - square meters of steel 4:2684t
 - performance characteristics 4:2685
 - wood 3:2442
- marine environments 2:1143, 4:2759
- metal dusting protection 1:300
- metallic coating protection 4:2519–2531
 - alternative coating systems 4:2528
 - anodic protection 4:2520
 - cathodic protection 4:2520
 - control options 2:1166
 - galvanized steel 2:1165
 - general discussion 4:2519
 - metallic–ceramic coatings 4:3188, 4:3188t
 - metal whiskers 4:2529, 4:2530f
 - multilayer coatings 4:2528
 - practical applications
 - aluminum (Al) 2:1165, 4:2525
 - cadmium (Cd) 4:2524
 - chromium (Cr) 4:2526
 - copper (Cu) 4:2525
 - lead (Pb) 4:2525
 - nickel (Ni) 4:2525
 - precious metals 4:2526, 4:2526f, 4:2527f
 - tin (Sn) 4:2525
 - zinc coatings 2:1165, 4:2524
 - research developments
 - environmental classification 4:2528, 4:2528t
 - galvanic coupling 4:2527
 - general discussion 4:2526
 - porosity 4:2528
 - selection factors
 - application methods 4:2521
 - coating properties 4:2523
 - corrosion resistance 4:2521
 - economic factors 4:2524
 - galvanic coupling compatibility 4:2522, 4:2522t
 - substrate property effects 4:2523
 - sprayed coatings 4:2618, 4:2626
- metallic cultural heritage preservation
 - coating types
 - acrylic coatings 4:3328
 - cellulose nitrate 4:3331
 - general discussion 4:3328
 - microcrystalline waxes 4:3330
 - silanes 4:3331
 - conservation-specific coatings 4:3324, 4:3325f
 - patinas 4:3326, 4:3327f, 4:3328f
 - surface preparation 4:3327, 4:3328f
- metal–matrix composites 3:2267
- microbially-induced corrosion (MIC) 2:1186
- microcrystalline waxes 4:3330
- noble metals 3:2221
- nonbiocidal coatings 4:2692, 4:2692t
- organic coatings
 - application methods 4:2637–2642
 - air-assisted airless spray application 4:2640
 - air atomized spray application 4:2638
 - airless spray application 4:2639
 - applicator skill 4:2641
 - brush application 4:2638
 - dip coating 4:2641
 - electrostatic spray application 4:2640
 - environmental conditions 4:2641
 - flow coating 4:2641
 - fluidized bed coating 4:2641
 - general discussion 4:2637, 4:2654
 - heated spray application 4:2640
 - high-volume low-pressure (HVL) spraying techniques 4:2610, 4:2639
 - roller application 4:2638
- automotive industry
 - antichip coatings 4:3173
 - anticorrosive waxes 4:3173
 - general discussion 4:3171
 - pretreatment guidelines 4:3171
 - primers 4:3172
 - seam sealants 4:3173
 - surfacers 4:3173
 - underbody protection 4:3173
- background information 4:2644
- characteristics 4:2646
- corrosion-protective coatings 4:2666–2677
 - active metal-rich pigmentation 4:2646f, 4:2648
 - aluminum alloys 3:2006
 - barrier protection 4:2646f, 4:2647, 4:2648f
 - basic concepts 4:2645, 4:2646f
 - cathodic protection 4:2646f, 4:2648, 4:2758, 4:2758f
 - general discussion 4:2647, 4:2666
 - inhibitor release coatings 4:2646f, 4:2649
 - iron and steel 4:2667
 - magnesium alloys 3:2036
 - multilayered coating system 4:2648f
 - paint protection mechanisms 4:2669
 - performance predictions 4:2676
 - smart coatings 4:2650
- corrosion test methods
 - abrasion tests 2:1511
 - adherence tests 2:1510
 - coating behavior 2:1508
 - coating evaluations 2:1510
 - distensibility 2:1511
 - electrochemical tests 2:1509
 - exposure cabinets 2:1510
 - exposure conditions 2:1509
 - field and plant tests 2:1510
 - general discussion 2:1508
 - hardness 2:1511
 - impact tests 2:1511
 - laboratory tests 2:1509
 - specimen preparation techniques 2:1509
- formulation process
 - combinatorial methods 4:2661
 - component volume–coarseness relationship plot 4:2662f
 - critical pigment volume concentration (CPVC) 4:2657, 4:2662f, 4:2662t
 - design process 4:2655, 4:2655f, 4:2656f, 4:2657f, 4:2658f, 4:2659f
 - film permeability 4:2662f
 - film resistance 4:2662f
 - formulation flow chart 4:2660f
 - formulation specifications 4:2659, 4:2663t
 - general discussion 4:2646
 - pigment volume concentration (PVC) 4:2657, 4:2662f, 4:2662t
 - production flow chart 4:2661f
 - raw material selection 4:2655f, 4:2656f, 4:2657f, 4:2658f, 4:2659f
 - volume effects 4:2657, 4:2662f, 4:2662t

- coatings (*continued*)
- general discussion 4:2664
 - pigments
 - colored pigments 4:2653
 - general discussion 4:2652
 - inert/extender pigments 4:2653
 - inhibitive pigments 4:2652, 4:2995*t*, 4:2996
 - reactive metal pigments 4:2653
 - polymers
 - acrylic polymers 4:2652
 - alkyds 4:2652
 - characteristics 4:2651
 - epoxies 4:2651
 - general discussion 4:2651
 - polymer matrix systems 4:2652
 - polyurethane/polyurea coatings 4:2652
 - sol-gel materials 4:2652
 - primary components 4:2645*f*
 - additives 4:2653
 - general discussion 4:2645, 4:2650
 - pigments 4:2652
 - polymers 4:2651
 - solvents/carrier fluids 4:2654
 - testing procedures 4:2646, 4:2663
 - wet adhesion 4:2655
 - paints and organic coatings 4:2643–2665, 4:2666–2677
 - anodic passivation
 - basic pigments 4:2670
 - general discussion 4:2670
 - soluble pigments 4:2670
 - application methods 4:2637–2642
 - air-assisted airless spray application 4:2640
 - air atomized spray application 4:2638
 - airless spray application 4:2639
 - applicator skill 4:2641
 - brush application 4:2638
 - dip coating 4:2641
 - electrostatic spray application 4:2640
 - environmental conditions 4:2641
 - flow coating 4:2641
 - fluidized bed coating 4:2641
 - general discussion 4:2637, 4:2654
 - heated spray application 4:2640
 - high-volume low-pressure (HVLP) spraying techniques 4:2639
 - roller application 4:2638
 - automotive industry
 - antichip coatings 4:3173
 - anticorrosive waxes 4:3173
 - general discussion 4:3171
 - pretreatment guidelines 4:3171
 - primers 4:3172
 - seam sealants 4:3173
 - surfacers 4:3173
 - underbody protection 4:3173
 - background information 4:2644
 - characteristics 4:2646
 - conductive paints 4:2792
 - corrosion inhibitors 4:2995, 4:2995*t*
 - corrosion-protective coatings
 - active metal-rich pigmentation 4:2646*f*, 4:2648
 - barrier protection 4:2646*f*, 4:2647, 4:2648*f*
 - basic concepts 4:2645, 4:2646*f*
 - cathodic protection 4:2646*f*, 4:2648
 - general discussion 4:2647
 - inhibitor release coatings 4:2646*f*, 4:2649
 - multilayered coating system 4:2648*f*
 - smart coatings 4:2650
 - formulation process
 - combinatorial methods 4:2661
 - component volume-coarseness relationship plot 4:2662*f*
 - critical pigment volume concentration (CPVC) 4:2657, 4:2662*f*, 4:2662*t*
 - design process 4:2655, 4:2655*f*, 4:2656*f*, 4:2657*f*, 4:2658*f*, 4:2659*f*
 - film permeability 4:2662*f*
 - film resistance 4:2662*f*
 - formulation flow chart 4:2660*f*
 - formulation specifications 4:2659, 4:2663*t*
 - general discussion 4:2646
 - pigment volume concentration (PVC) 4:2657, 4:2662*f*, 4:2662*t*
 - production flow chart 4:2661*f*
 - raw material selection 4:2655*f*, 4:2656*f*, 4:2657*f*, 4:2658*f*, 4:2659*f*
 - volume effects 4:2657, 4:2662*f*, 4:2662*t*
 - general discussion 4:2664, 4:2666
 - hydrogen embrittlement 2:907
 - iron and steel
 - anodic reactions 4:2669
 - cathodic reactions 4:2667
 - oxygen diffusion 4:2668, 4:2668*t*
 - rust formation 4:2667
 - water diffusion 4:2668, 4:2668*t*
 - liquid-applied coatings (paint) 4:2705, 4:2706*f*, 4:3283, 4:3283*t*
 - paint inspection procedures 4:2720–2727
 - duties and requirements 4:2720
 - general discussion 4:2727
 - inspection considerations 4:2722
 - quality control methods 4:2720
 - training and certification 4:2722
 - paint protection mechanisms
 - anodic passivation 4:2670
 - cathodic protection 4:2669
 - resistance inhibition 4:2671
 - performance predictions 4:2676
 - pigments
 - colored pigments 4:2653
 - corrosion-resistant coatings 4:2995*t*, 4:2996
 - general discussion 4:2652
 - inert/extender pigments 4:2653
 - inhibitive pigments 4:2652
 - reactive metal pigments 4:2653
 - pipeline corrosion management 4:3283, 4:3283*t*
 - polymers
 - acrylic polymers 4:2652
 - alkyds 4:2652
 - characteristics 4:2651
 - epoxies 4:2651
 - general discussion 4:2651
 - polymer matrix systems 4:2652
 - polyurethane/polyurea coatings 4:2652
 - sol-gel materials 4:2652
 - primary components 4:2645*f*
 - additives 4:2653
 - general discussion 4:2645, 4:2650
 - pigments 4:2652
 - polymers 4:2651
 - solvents/carrier fluids 4:2654
 - resistance inhibition
 - below-film electrolytes 4:2671
 - electrolyte concentrations 4:2675
 - film thickness 4:2675, 4:2675*t*
 - general discussion 4:2671
 - ionogenic materials 4:2671
 - outside-film electrolytes 4:2672, 4:2673*f*, 4:2674*f*
 - solvents 4:2676
 - temperature effects 4:2675
 - testing procedures 4:2646, 4:2663
 - wet adhesion 4:2655
 - phosphate coatings 4:2494–2502
 - coating characteristics
 - analytical tests and results 4:2499*t*
 - coating types 4:2496, 4:2497*t*
 - composition 4:2498
 - heating effects 4:2498, 4:2498*f*
 - metal surface factors 4:2497
 - phosphate solution effects 4:2497
 - post-phosphating rinse treatments 4:2499
 - structure 4:2498
 - coating formation
 - accelerators 4:2496
 - deposition mechanisms 4:2495
 - evolving-gas compositions 4:2496*t*
 - coating processes 4:2500*t*
 - general discussion 4:2494

- performance characteristics
 - coating weight 4:2501*r*
 - corrosion protection 4:2499
 - phosphophyllite–hopeite ratio 4:2501
 - testing procedures 4:2500
- scale inhibition/control 4:2917*r*, 4:2916
- steel coatings 4:2500*r*
- pipelines
 - external corrosion prevention strategies
 - alternating current (AC) monitoring surveys 4:3286
 - coating failures 4:3284
 - coating requirements 4:3281
 - coating types 4:3283, 4:3283*r*
 - condition monitoring 4:3285
 - direct current voltage gradient (DCVG) surveys 4:3285
 - field joint coatings 4:3284
 - FBE-polypropylene
 - application frame 4:2713*f*
 - application methods 4:2715*f*
 - basic concepts 4:2713
 - coextruded sheet method 4:2714*f*
 - coextruded spiral tape 4:2715*f*
 - injection molding 4:2714*f*
 - plastic extrusion welding 4:2714*f*
 - field joint coatings
 - FBE-polypropylene 4:2713, 4:2714*f*
 - FBE powder coatings 4:2712, 4:2713*f*
 - general discussion 4:2711
 - liquid-applied field joint coatings 4:2711, 4:2712*f*
 - radiation cross-linked heat shrink sleeves 4:2712
 - internal corrosion prevention strategies 4:3296
 - line pipe coatings
 - coal tar and asphalt/bitumen enamels 4:2709
 - FBE powder coatings 4:2708*f*, 4:2709, 4:2836*f*
 - general discussion 4:2707
 - line pipe coating plant schematic diagram 4:2708*f*
 - polyolefin coatings 4:2708*f*, 4:2710
 - liquid-applied coatings (paint) 4:2705
 - refurbishment methods 4:2716
 - resistance measurements 4:2821
 - thermal insulation 4:2715, 4:2716*f*
- plated coatings 4:2577–2609
 - cathode corrosion
 - agitation processes 4:2592
 - corrosion potential 4:2591, 4:2591*r*
 - general discussion 4:2588
 - high speed deposition 4:2591
 - passive alloys 4:2590
 - pulse plating 4:2592
 - service corrosion effects 4:2591
 - silver plating/strike baths 4:2589
 - zinc diecastings 4:2589, 4:2589*f*
 - corrosion protection methods 4:2578
 - electrodeposit properties
 - coating thickness 4:2598
 - compositional effects 4:2601
 - current path geometry 4:2600
 - internal stress effects 4:2601, 4:2602*f*
 - mechanical properties 4:2602
 - porosity 4:2603, 4:2604*f*, 4:2605*f*
 - structure-dependent properties 4:2601
 - substrate–coating interdiffusion 4:2603
 - throwing power 4:2599, 4:2599*f*
 - historical background 4:2578
 - ionic liquids 4:2605
 - nonconductors
 - general discussion 4:2580
 - mechanical pretreatments 4:2580
 - plating methods
 - addition agents 4:2585
 - anodes 4:2586, 4:2587*f*, 4:2588*r*
 - aqueous electrolytes 4:2582, 4:2582*f*
 - cathode corrosion 4:2588
 - complex ions 4:2584, 4:2585*f*
 - conducting salts 4:2585
 - cyanide ions 4:2584, 4:2585*f*, 4:2589
 - diffusion processes 4:2585*f*
 - electroplating 4:2581
 - industrial electroplating techniques 4:2597
 - plating baths 4:2585
 - postplating treatments 4:2598
 - rinsing processes 4:2597
 - simple ions 4:2584
 - structure-influencing factors 4:2593
 - pretreatment options 4:2579
 - recent research developments 4:2606
 - structure-influencing factors
 - banding effects 4:2596*f*
 - current characteristics 4:2596
 - electrolyte effects 4:2595
 - epitaxy 4:2593, 4:2594*f*
 - pseudomorphism 4:2593, 4:2593*f*, 4:2595*f*
 - substrates
 - banding effects 4:2596*f*
 - corrosion potential 4:2591, 4:2591*r*
 - degreasing 4:2579
 - electroplating 4:2581
 - epitaxy 4:2593, 4:2594*f*
 - general discussion 4:2578
 - oxide removal/cleaning 4:2579
 - pretreatment options 4:2579
 - pseudomorphism 4:2593, 4:2593*f*, 4:2595*f*
 - process equipment protection 4:3212
 - refractory metals and alloys 1:207
 - resistance measurements 4:2821
 - self-polishing copolymers (SPCs) 4:2691–2692, 4:2692*r*
 - silanes 4:3331
 - soil corrosion 4:2702–2719
 - buried and ground-contact structures 4:2702
 - coating characteristics 4:2704
 - coating types
 - cold-applied tapes 4:2707
 - field joint coatings 4:2711, 4:2711*f*, 4:3284
 - laminated tapes 4:2707
 - line pipe coatings 4:2707, 4:2708*f*
 - liquid-applied coatings (paint) 4:2705, 4:2706*f*, 4:3283, 4:3283*r*
 - petrolatum tapes 4:2707
 - pressure-sensitive tapes 4:2707
 - FBE-polypropylene
 - application frame 4:2713*f*
 - application methods 4:2715*f*
 - basic concepts 4:2713
 - coextruded sheet method 4:2714*f*
 - coextruded spiral tape 4:2715*f*
 - injection molding 4:2714*f*
 - plastic extrusion welding 4:2714*f*
 - field joint coatings
 - FBE-polypropylene 4:2713, 4:2714*f*
 - FBE powder coatings 4:2712, 4:2713*f*
 - general discussion 4:2711
 - liquid-applied field joint coatings 4:2711, 4:2712*f*
 - pipeline corrosion management 4:3284
 - radiation cross-linked heat shrink sleeves 4:2712
 - set-up 4:2711*f*
 - line pipe coatings
 - coal tar and asphalt/bitumen enamels 4:2709, 4:2812*r*, 4:3283, 4:3283*r*
 - FBE powder coatings 4:2708*f*, 4:2709, 4:2812*r*, 4:2836*f*, 4:3283, 4:3283*r*
 - general discussion 4:2707
 - line pipe coating plant schematic diagram 4:2708*f*
 - polyolefin coatings 4:2708*f*, 4:2710, 4:2812*r*, 4:3283, 4:3283*r*
- pipelines
 - FBE-polypropylene 4:2713
 - field joint coatings 4:2711, 4:2711*f*, 4:2713
 - line pipe coatings 4:2707, 4:2708*f*
 - liquid-applied coatings (paint) 4:2705, 4:2706*f*
 - refurbishment methods 4:2716
 - thermal insulation 4:2715, 4:2716*f*
 - quality control methods 4:2717
 - surface preparation 4:2705
 - solid oxide fuel cells (SOFCs) 1:509, 1:510*f*, 1:511*f*
 - solvent-free epoxy coatings 4:2694*r*
 - tape wrap systems 4:3283, 4:3283*r*
 - temporary protective coatings 4:2678–2682

- coatings (*continued*)
- application methods 4:2679*t*, 4:2681
 - characteristics
 - hard-film materials 4:2679, 4:2679*t*
 - oil-type materials 4:2679*t*, 4:2680
 - soft-film materials 4:2678, 4:2679*t*
 - strippable coatings 4:2679*t*, 4:2680
 - volatile corrosion inhibitors 4:2679*t*, 4:2680
 - water displacing agents 4:2679*t*, 4:2680
 - failure mechanisms 4:2681
 - functionality 4:2681
 - general discussion 4:2678
 - suitability 4:2680
 - thermal barrier coatings
 - gas turbines
 - characteristics 1:527*f*
 - damage mechanisms 1:527
 - operation principles 1:524*f*
 - spallation models 1:528*f*, 1:529, 1:529*f*
 - high-temperature coatings
 - aeroengine applications 1:704*f*
 - characteristics 1:704
 - chemical failures 1:719, 1:720*f*
 - cross-section diagram 1:705*f*
 - failure characteristics 1:713, 1:714*f*, 1:715*f*, 1:716*f*
 - martensite formation 1:717
 - mechanical instabilities 1:716*f*, 1:717
 - oxidation-induced failure 1:712
 - schematic cross-section diagram 1:705*f*
 - strain energy 1:715
 - subcritical crack growth 1:716, 1:721*f*
 - surface roughness 1:718, 1:719*f*, 1:720, 1:720*f*, 1:721*f*
 - time-to-failure data plot 1:713*f*
 - topcoat cracking 1:716*f*, 1:721*f*
 - transformation strains 1:716
 - intermetallic alloys 1:664–665
 - laser cladding (LC) 4:2625
 - sprayed coatings 4:2620
 - tin coatings
 - basic concepts 4:2556
 - corrosion behavior 4:2564
 - general discussion 3:2074
 - hot tinning 4:2571
 - titanium nitride (TiN) coatings 2:1316
 - uranium alloys 3:2188
 - vitreous enamel coatings 3:2330–2336
 - characteristics 3:2330, 3:2331*t*
 - chemical resistance
 - acid resistance 3:2334
 - alkali resistance 3:2335
 - atmospheric resistance 3:2335
 - detergent resistance 3:2335
 - general discussion 3:2333
 - water resistance 3:2335
 - corrosion-resistant properties
 - abrasion resistance 3:2333*t*
 - chemical resistance 3:2333
 - mechanical properties 3:2332, 3:2332*t*, 3:2333*t*
 - thermal properties 3:2333
 - glass-lined steel equipment manufacturing processes
 - certifications and standards 3:2322, 3:2322*t*, 3:2323*t*
 - glass formulations 3:2319, 3:2321*f*, 3:2321*t*
 - glass preparation 3:2321
 - lining process 3:2323
 - metal preparation 3:2322
 - metal/metal preparation
 - application and fusion processes 3:2332
 - cast iron 3:2331
 - enamel bonding 3:2332
 - steel 3:2331
 - pipeline corrosion management 4:2812*t*, 4:3283, 4:3283*t*
 - cobalt (Co) 3:1916–1936
 - alloys
 - alloying element influences 3:1918, 3:1920*f*
 - alumina-forming alloys 1:606–645
 - alumina scale formation 1:623*f*
 - breakaway oxidation 1:634
 - compositions 1:607, 1:608*t*, 1:609*t*
 - creep rupture life 1:611*f*
 - environmental conditions 1:637
 - functionality 1:609*t*
 - general discussion 1:640
 - hydrogen permeability 1:612*f*
 - selective oxidation 1:612
 - spalled oxide mass 1:610*f*, 1:617*f*
 - steady-state oxidation 1:621
 - total mass gain 1:607, 1:610*f*, 1:614*f*, 1:617*f*
 - transient oxidation 1:617
 - cobalt–chromium–aluminum–yttrium (CoCrAlY) alloys 1:537*f*, 1:631
 - cobalt–chromium–carbon (Co–Cr–C) system 3:1920
 - cobalt–chromium (CoCr) alloys 1:584, 1:586*f*, 1:593, 1:594*f*, 1:602*t*
 - cobalt–chromium–molybdenum (CoCrMo) alloy
 - corrosion fatigue 2:1318
 - corrosion resistance 2:764, 2:1314, 3:1927
 - crevice corrosion 2:1317
 - galvanic corrosion 2:1319, 3:1928
 - historical background 2:1310
 - hydrogen embrittlement 2:1317
 - pitting corrosion 2:1317
 - replacement joints 2:1046*f*, 2:1047*f*
 - zirconium (Zr)-based bulk metallic glasses 3:2200
 - cobalt–chromium–tungsten (Co–Cr–W) system 3:1920
 - cobalt–nickel–chromium–aluminum–yttrium (CoNiCrAlY) alloys 1:537*f*, 4:2552
 - comparison studies 1:595*t*
 - compositions 1:246*t*
 - corrosion behavior 3:1924, 3:1926*f*, 3:1927*f*
 - flow-induced corrosion 2:982*f*
 - general discussion 3:1916
 - global rating parameter (KB₄) 1:596*f*
 - iron–nickel–cobalt (Fe–Ni–Co) alloys 1:551*f*
 - magnesium alloys 3:2016*t*
 - materials selection 2:982*f*
 - nickel-based superalloys 1:693*t*
 - nickel–chromium–cobalt (Ni–Cr–Co) alloys 1:250
 - nickel–cobalt–aluminum–yttrium (NiCoAlY) alloys 4:2624–2625
 - nitridation resistance 1:309*f*
 - process equipment materials 4:3211
 - processing techniques 3:1920
 - stacking fault energy 3:1919–1920, 3:1920*f*
 - stainless steels 3:1811
 - Stellite 6 steel 3:1917, 3:1917*f*
 - strengthening mechanisms 3:1922
 - wear effects 1:349
 - wrought refractory cobalt–chromium (Co–Cr) alloys 1:602*t*
 - cobalt boride (Co₃B) 3:2195
 - cobalt oxide (Co₂O₃) 1:200
 - cobalt oxide (Co₃O₄) 1:200, 1:320*f*, 1:389*f*, 1:476*f*, 1:477*f*
 - cobalt oxide (CoO)
 - amorphous alloys 3:2197*f*
 - diffusion processes 1:127
 - enamel frit compositions 3:2321*t*, 3:2331*t*
 - equilibrium oxygen partial pressure 1:410*f*
 - fracture toughness values 1:168*t*
 - oxidation processes 1:182*t*, 1:183*f*, 1:200
 - Pilling–Bedworth ratio (PBR) 1:146*t*, 1:160*t*
 - point defects 1:127
 - Poisson ratios 1:170*t*
 - surface fracture energies 1:170*t*
 - thermal expansion coefficients 1:145*f*
 - cobalt silicide (CoSi/Co₂Si/CoSi₂) 1:125–126, 1:126*f*, 1:209
 - cobalt sulfate (CoSO₄) 1:477*f*
 - corrosion behavior
 - biomedical devices
 - galvanic corrosion 3:1928
 - joints 3:1927
 - cobalt-based alloys 3:1924, 3:1926*f*, 3:1927*f*
 - electrochemistry 3:1923, 3:1923*f*
 - erosion–corrosion 3:1929, 3:1930*f*
 - galvanic corrosion 3:1928
 - normalized alloy content 3:1932, 3:1933*t*
 - oxidation 1:200, 3:1926
 - passive film analysis 3:1923, 3:1924*f*, 3:1925*f*
 - potential–pH (Pourbaix) diagram 3:1923*f*

- total weight loss (TWL) tests 3:1930, 3:1933f, 3:1934f
 wear–corrosion 3:1928, 3:1931, 3:1932f
- crystal structure 1:55r
- electrochemical scanning tunnel microscopy (ECSTM) 2:1436
- galvanic corrosion 3:1928
- high-temperature oxidation 1:183f
- magnesium alloys 3:2016r
- metallurgical properties
- alloying processes
 - alloying additions 3:1918, 3:1918r
 - alloying element influences 3:1918, 3:1920f
 - stacking fault energy 3:1919–1920, 3:1920f
 - Stellite 6 steel 3:1917, 3:1917f
 - alloy systems 3:1920
 - general discussion 3:1916
 - processing techniques 3:1920
 - strengthening mechanisms 3:1922
 - structural characteristics 3:1918, 3:1919f, 3:1920f
 - superalloys 3:1918
- nitric acid (HNO₃) solutions 2:1252r
- oxidation processes 1:200
- rare earth magnets 2:1316
- stainless steels 3:1811
- surgical implants
- cobalt–chromium–molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
 - environmental conditions 2:1311
 - health effects 2:1310, 2:1310r
 - historical background 2:1308
 - thermal expansion coefficients 1:145f
 - zinc–cobalt–iron (Zn–Co–Fe) coatings 4:3188r
 - zinc–cobalt (Zn–Co) coatings 4:3188r
- cobwebbing 4:2734
- cohesive bond failure 3:2421, 3:2466f, 3:2470f
- coke breeze 4:2789, 4:2790r
- cold-applied tapes
- laminated tapes 4:2707
 - petrolatum tapes 4:2707
 - pressure-sensitive tapes 4:2707
- cold-gas dynamic spraying (CGDS) 4:2612r, 4:2616
- colored pigments 4:2653
- combined digital close interval potential surveys (CIPS) 4:2853, 4:2854f
- commercial glasses 3:2307
- composite materials
- above-water fastener selection 2:847f
 - aircraft corrosion
 - materials selection 4:3184
 - protective treatments 4:3190
 - below-water fastener selection 2:849f
 - metal–matrix composites 3:2250–2269
 - characteristics 3:2251
 - chemical degradation
 - aluminum carbide (Al₄C₃) hydrolysis 3:2263
 - general discussion 3:2262
 - mica degradation 3:2263
 - continuous-reinforced metal–matrix composites
 - characteristics 3:2251, 3:2251f
 - practical applications 3:2252, 3:2253f
- corrosion characteristics
- chemical degradation 3:2262
 - electrochemical effects 3:2253
 - environmental conditions 3:2264
 - general discussion 3:2253
 - interphase effects 3:2262
 - secondary effects 3:2263
- corrosion protection methods 3:2267
- discontinuous-reinforced metal–matrix composites
- characteristics 3:2252, 3:2252f
 - practical applications 3:2252, 3:2253f
- electrochemical effects
- anodic/cathodic polarization diagram 3:2254f, 3:2255f, 3:2256f
 - cathodic constituent content 3:2260, 3:2261f
 - cathodic current densities 3:2260, 3:2260r
 - environmental conditions 3:2254, 3:2255f
 - general discussion 3:2253
 - localized corrosion 3:2259, 3:2259f, 3:2261f, 3:2262f
 - matrix metal corrosion 3:2254, 3:2255f
 - microstructure 3:2259, 3:2259f
 - n*-type semiconductors 3:2256, 3:2256f
 - p*-type semiconductors 3:2256, 3:2256f
 - reinforcement area fraction 3:2258, 3:2258f, 3:2259f
 - reinforcement electrochemistry 3:2255, 3:2256f
 - reinforcement photoelectrochemistry 3:2256
 - reinforcement resistivity 3:2257, 3:2257r, 3:2258f
- environmental conditions
- general discussion 3:2264
 - humidity chamber exposure 3:2266, 3:2266f
 - immersion exposure 3:2265, 3:2265f
 - outdoor exposure 3:2266, 3:2267f, 3:2267r
- general discussion 3:2267
- resistivities 3:2257r
- secondary effects
- dislocation density 3:2264
 - general discussion 3:2263
 - intermetallic alloys 3:2263, 3:2263r
 - low-integrity diffusion bonds 3:2264
 - microstructural chlorides 3:2264, 3:2264f
 - processing-induced corrosion 3:2264
- polymer matrix systems 3:2387–2406
- accelerated ageing 3:2395
 - ageing effects
 - chemical processing industry 3:2401
 - marine industry 3:2404
 - oil and gas industry 3:2398, 3:2398f, 3:2399f, 3:2400f, 3:2401f
 - supersonic flight 3:2396
 - ageing mechanisms
 - chemical ageing 3:2393
 - fire resistance 3:2394
 - general discussion 3:2390
 - hydrothermal effects 3:2391
 - mechanical degradation 3:2394
 - physical ageing 3:2391
 - synergistic effects 3:2394
 - thermooxidative degradation 3:2392
 - time-dependent effects 3:2391
 - ultraviolet (UV) ageing 3:2393
 - weather degradation 3:2393
- chemical processing industry
- Arrhenius relationship 3:2403
 - ASTM standard for long-term chemical resistance 3:2403
 - Barcol hardness changes 3:2403f
 - environmental conditions 3:2401
 - failures and defects 3:2402f
 - mass change–concentrated acid plot 3:2403f
 - scrubbing tower 3:2401f
 - semiempirical corrosion approach 3:2404
 - uniform corrosion 3:2402f
- general discussion 3:2388, 3:2405
- organic coatings 4:2652
- strength comparisons 3:2388f
- computational fluid dynamics 2:985
- CONCAWE (Europe) 4:3273
- concrete
- above-water fastener selection 2:847f
 - admixtures 3:2356
 - aggregates 3:2355
 - aluminum alloys 3:2000
 - background information 3:2355
 - below-water fastener selection 2:849f
 - cathodic protection 4:2755, 4:2812, 4:2827, 4:2830f
 - comprehensive strength 3:2357, 3:2357r
 - concreting process 3:2356
 - corrosion inhibitors 4:2996
 - degradation conditions
 - alkali–silica reaction (ASR) 3:2362, 3:2362f
 - cracking
 - early age thermal cracking 3:2358
 - general discussion 3:2358
 - long-term drying shrinkage 3:2358, 3:2358f
 - plastic settlement cracking 3:2358, 3:2358f
 - plastic shrinkage cracking 3:2358
 - mechanical damage
 - abrasion/erosion 3:2366, 3:2366f
 - cavitation 3:2366

- concrete (*continued*)
 exfoliation 3:2366, 3:2366f
 fire 3:2367
 frost 3:2366, 3:2366f
 steel reinforcement corrosion
 carbonation 3:2359, 3:2359f
 cathodic protection 4:2755, 4:2812t, 4:2827, 4:2830f
 characteristics 3:2358
 chloride-induced corrosion 3:2359, 3:2359f
 chloride ion diffusion 3:2359
 chloride ion selective electrodes 3:2362
 chloride ion sources 3:2359
 corrosion inhibitors 4:2996
 corrosion ladder 3:2361
 diffusion cell test 3:2360
 immersion tests 3:2360
 resistivity tests 3:2360
 retrieved sample tests 3:2361
 testing errors 3:2361
 sulfate-induced corrosion
 acid corrosion 2:1180
 conventional sulfate attacks 3:2363, 3:2363f
 delayed ettringite formation 3:2365
 thaumasite form of sulfate attack (TSA) 3:2364
 impressed current anodes 4:2798, 4:2815
 steel-reinforced concrete structures 4:2812t, 4:2827, 4:2830f
 water-cement ratio 3:2357
 water (H₂O) 3:2356
 condensate line corrosion 4:2948
 condensate treatment 4:2986
 conductive paints 4:2792
 conductive polymers 4:2791
 congruent phosphate treatment 4:2983
Contiophora puteana 3:2445
 conservation efforts
 acidic vapor corrosion 2:1326
 wood corrosivity 2:1328
 Conservation of Clean Air and Water (CONCAWE) 4:3157
 container glass 3:2307, 3:2308t, 3:2309t
 contaminated land 2:1153–1154
 continuous casting 3:1985
 controlled depletion polymers (CDPs) 4:2691–2692, 4:2692t
 convergent beam electron diffraction (CBED) 2:1417
 cooking oil 3:2428, 3:2430t
 cooling systems *see* industrial heating and cooling systems
 coordinated phosphate treatment 4:2982, 4:2983f
 copolymers 3:2371
 copper (Cu)
 age-hardenable nickel–chromium–iron–molybdenum–copper
 (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
 alkaline copper quat (ACQ) 2:1327
 aluminum alloys 3:1981
 amorphous alloys 3:2193–2194
 atmospheric corrosion 2:848f
 brazed joints 3:2452
 carbon dioxide (CO₂) environments 2:855f
 characteristics 3:1938
 coating characteristics 4:2525
 copper anode plating 4:2586, 4:2588t
 copper azoles 2:1327
 copper chloride (CuCl) 4:3315, 4:3332, 4:3333f
 copper–chromium–arsenic (CCA) preservatives 2:1327, 3:2441
 copper/copper alloys 3:1937–1973
 above-water fastener selection 2:847f
 acid pickling
 hydrochloric acid (HCl) 4:2992t
 nitric acid (HNO₃) 4:2993t
 sulfuric acid (H₂SO₄) 4:2992t
 aluminum–copper (Al–Cu) alloys 1:68f
 archaeological metals 2:1159, 4:3311f
 background information 3:1938
 below-water fastener selection 2:849f
 cathodic protection 4:2755, 4:2755t
 characteristics
 aluminum bronzes 3:1943, 3:1952t
 brasses 2:820, 3:1942, 3:1952t
 cast copper alloys 3:1941t, 3:1942t, 3:1952t
 copper–nickel–chromium (Cu–Ni–Cr) alloys 3:1943
 cupronickel alloys 3:1942, 3:1952t, 3:1967
 heat treatable copper alloys 3:1942
 high conductivity coppers 3:1942
 mechanical properties 3:1940t, 3:1942t
 nickel silvers 3:1943, 3:1952t
 physical properties 3:1940t
 pure copper 3:1938
 silicon bronzes 3:1943, 3:1952t
 tin bronze 3:1943
 wrought copper alloys 3:1939t, 3:1940t, 3:1952t
 compositions 1:246t, 3:1939t, 3:1941t
 contaminated environments
 brass-product stress corrosion 3:1961
 corrosivity 3:1960
 stress corrosion cracking (SCC) 3:1962
 copper–gold (Cu–Au) alloys 2:805f, 2:867t, 3:2215
 copper–zinc (Cu–Zn) alloys 1:68f
 corrosion potential 4:2591t
 corrosion prevention strategies 4:3320
 corrosive environments
 atmospheric corrosion 3:1946, 3:1947t
 contaminated environments 3:1960
 freshwater environments 3:1954
 general discussion 3:1946
 high-temperature oxidation 3:1965
 industrial chemicals 3:1962
 internal corrosion risks 4:3217f, 4:3218f
 natural water corrosion 3:1950
 polluted conditions 3:1963, 3:1964t, 3:1965f
 seawater 3:1958
 soil corrosion 2:1158, 2:1159f, 3:1949, 3:1949t
 corrosivity
 anhydrous hydrogen halide gases/hydrohalic acids 2:1214f, 2:1220, 2:1220f
 crevice corrosion 3:1952t
 electrode behavior 3:1944
 electrode potential relationships 3:1944
 potential–pH (Pourbaix) diagram 3:1945, 3:1945f
 theoretical aspects 3:1943
 dealloying mechanisms 2:802
 electroplated coatings 4:2578
 flow-induced corrosion 2:980, 2:981f, 2:982f
 freshwater environments
 chemical attacks 3:1956, 3:1956f
 corrosivity 3:1954
 dissolution conditions 3:1957
 microbially-induced corrosion (MIC) 3:1956, 3:1957f
 pipework systems 3:1954
 pitting corrosion 3:1954
 stress corrosion cracking (SCC) 3:1957, 3:1957f
 future developments
 antimicrobial benefits 3:1967
 cupronickel alloys 3:1967
 shape-memory alloys 3:1968
 galvanic corrosion 2:831f, 2:1119f, 3:1845f
 hydrofluoric acid (HF) corrosion 2:1214f
 industrial chemicals
 acid corrosion 3:1963
 alkali corrosion 2:1204, 3:1963
 corrosivity 3:1962
 hydrogen sulfide (H₂S) pollution 3:1963, 3:1964t, 3:1965f
 neutral solutions 3:1963
 organic compounds 3:1964
 intergranular corrosion 2:820
 lead–copper (Pb–Cu) alloys 3:2055, 3:2055t
 low-alloy steel 1:569
 marine environments
 corrosivity 2:1131, 3:1760f
 critical design velocities 2:1132t
 dealloying 2:1135
 dissolved oxygen–corrosion rate plot 2:1134f
 galvanic corrosion 2:1134–1135, 3:1757t
 impingement attacks 2:1134
 macrofouling 2:1133
 metal-ion concentration cell corrosion 2:1135
 pitting corrosion 2:1133–1134

- self-corrosion 2:1135
 shear stresses 2:1132*t*
 stress corrosion cracking (SCC) 2:1135
 sulfate-reducing bacteria (SRB) 2:1132–1133
 temperature–corrosion rate plot 2:1133*f*
- nickel–copper (Ni–Cu) alloys
 corrosion protection methods 2:1143
 corrosion resistance 3:1883
 galvanic corrosion 2:854*t*, 2:1119*f*
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 marine environments 2:1131, 2:1132*t*, 2:1133*f*, 2:1134*f*, 2:1135
 metal dusting 1:296, 1:296*f*
 stress corrosion cracking (SCC) 2:867*t*
- pitting corrosion
 carbon film pitting 3:1955, 3:1955*f*
 electrochemical processes 3:1955
 freshwater environments 3:1954
 hot soft water conditions 3:1955
 natural waters 3:1954
 Type III pitting 3:1955
 Type II pitting 3:1955
 Type I pitting 3:1955, 3:1955*f*
- process equipment materials 4:3210*f*, 4:3211
 protective treatments 3:1966, 4:3332, 4:3333*f*
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2245
 silver–copper (Ag–Cu) alloys 1:67*f*
 stainless steels 2:1232–1233, 2:1233*f*, 3:1809
 stress corrosion cracking (SCC) 3:1957, 3:1957*f*, 3:1962
 sulfuric acid (H₂SO₄) environments 2:1243
 uniform corrosion 2:729
- water corrosion
 brass dezincification 3:1952
 contaminated environments 3:1960
 freshwater environments 3:1954
 impingement attacks 3:1950, 3:1951*f*, 3:1952*t*
 natural waters 3:1950
 pitting corrosion 3:1954
 seawater 3:1952*t*, 3:1958
 selective attacks 3:1954
 wood 2:1326
- copper cyanide (CuCN) 4:2591*t*
 copper–magnesium–containing alloys 3:1981
 copper naphenate 2:1327
 copper–nickel–beryllium (CuNiBe) intermetallic compound 3:2177
 copper oxide (Cu₂O) 1:146*t*
 copper oxide (CuO) 1:160*t*, 1:477*f*, 2:1086–1087, 2:1087*f*, 3:2197*f*
 copper sulfate (CuSO₄)
 corrosion test methods 2:1479*t*, 2:1480*f*, 2:1481, 2:1482*f*
 reference electrodes
 cathodic protection 4:2754, 4:2754*t*, 4:2850*f*
 common reference electrodes 2:1371*t*
 design guidelines 1:46, 1:47*f*, 1:48*t*
 potential measurements 4:2848, 4:2849*t*
- corrosive environments 1:92
 corrosivity 1:90
 crystal structure 1:55*t*
 cuprite (Cu₂O) 4:2942*t*
 dental amalgams 2:1310
 diffusion coatings 4:2535*t*, 4:2536*t*
 electroplated coatings 4:2584
 erosion resistance 2:985*f*
 exchange current density 3:2217*t*
 galvanic corrosion 2:831*f*, 2:850*t*, 2:851*t*, 2:852*t*, 2:1119*f*, 3:1845*f*
 high conductivity coppers 3:1942
 high-temperature oxidation 3:1965
 hydrogen sulfide (H₂S) environments 2:855*f*
 magnesium alloys 3:2015, 3:2016*t*, 3:2019*t*
 microscopy-based analytical techniques
 aluminum–copper (Al–Cu) alloy oxide film 2:1410–1411, 2:1412*f*
 electrochemical scanning tunnel microscopy (ECSTM) 2:1436, 2:1437*f*
- nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu)
 alloys
 alloy 20
 corrosion resistance 3:1891
 galvanic corrosion 2:831*f*, 2:1119*f*
 historical development 3:1882*t*
- hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 maximum depth of crevice attack 2:1128*t*
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 31
 acetic acid production 3:1908
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 corrosion rates 3:1905*f*, 3:1911*f*
 corrosion resistance 3:1892, 3:1900
 fine and specialty chemicals 3:1910
 historical development 3:1882*t*
 hydrochloric acid (HCl) isocorrosion diagram 3:1894*f*
 major alloying elements 3:1881*t*
 phosphoric acid (H₃PO₄) production 3:1905, 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*, 3:1900, 3:1901*t*
 pollution controls 3:1912
 stability limits 3:1895*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237*f*, 3:1893*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 tank transport studies 3:1912
- alloy 33
 alkali corrosion 2:1200*f*
 caustic soda (NaOH) production 3:1902, 3:1902*f*
 corrosion loss measurements 3:1896*t*, 3:1897*t*
 corrosion resistance 3:1892, 3:1896*f*
 historical development 3:1882*t*
 major alloying elements 3:1881*t*
 pitting resistance 3:1894*f*, 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 825
 alkali corrosion 2:1200*f*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 hydrohalic acid corrosion 2:1217*f*, 2:1219*f*
 major alloying elements 3:1881*t*
 nuclear waste isolation 2:767
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*, 2:1243*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 vinyl chloride monomer (VCM) production 3:1908
- alloy G-3
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
- alloy G-30
 corrosion loss measurements 3:1896*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 major alloying elements 3:1881*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
- corrosion resistance 3:1891
 historical development 3:1882*t*
 laser surface alloying (LSA) 4:2631
 major alloying elements 3:1881, 3:1881*t*
- nickel–copper (Ni–Cu) alloys
 corrosion protection methods 2:1143
 corrosion resistance 3:1883
 erosion resistance 2:985*f*
 flow-induced corrosion 2:982*f*
 galvanic corrosion 2:831*f*, 2:1119*f*, 3:1845*f*
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 marine environments 2:1131, 2:1132*t*, 2:1133*f*, 2:1134*f*, 2:1135
 materials selection 2:982*f*
 metal dusting 1:296, 1:296*f*
 phase diagram 1:64*f*
 stress corrosion cracking (SCC) 2:867*t*

- copper (Cu) (*continued*)
 nitric acid (HNO₃) solutions 2:1252
 pH factors 2:1104–1105
 physical properties 3:2054r
 preservative treatments 2:1327
 production processes 3:1862
 redox couples equilibrium potential values 1:26r
 reference electrodes 1:46, 1:47f, 1:48t, 2:1371t, 4:2848, 4:2849t, 4:2850f
 scale inhibitors/dispersants 4:2993t
 soil corrosion 2:1152f, 2:1158, 2:1159f
 solders 3:2075
 stainless steels 2:1232–1233, 2:1233f, 3:1809, 3:1856t, 3:1863r
 standard reduction potential 3:2074t
 stress corrosion cracking (SCC) 2:867t
 sulfate-reducing bacteria (SRB) 2:1175, 2:1178, 2:1178f
 sulfidation corrosion 1:246f
 uniform corrosion 2:729
 water chemistry 2:1098t
 wood corrosivity 2:1326
 zirconium (Zr)-based bulk metallic glasses 3:2199
- copper steel 3:1724f
- cordierite (Al₃Mg₂(Si₅AlO₁₈)) 1:674
- corrosion **1:89–100**
 basic concepts
 classifications 1:95t
 general discussion 1:96
 terminology 1:96, 1:97t
 definitions 1:90
 economic aspects **4:3040–3051**
 cost control options
 construction material selection 4:3043, 4:3043t, 4:3044f, 4:3044t
 expected value analysis 4:3045–3046, 4:3046f
 lowest life cycle costing 4:3043, 4:3047, 4:3062
 net cash flow/net present value 4:3044f, 4:3044t
 repair and maintenance options 4:3044, 4:3045t
 risk and uncertainties analyses 4:3045, 4:3046f
 individual organizations
 control options 4:3043
 cost sources 4:3040
 discounted cash flow 4:3042, 4:3062
 investment appraisals 4:3041, 4:3041f
 net cash flow/net present value 4:3042, 4:3042f, 4:3042t, 4:3062
 return on investment 4:3042–3043
 quantification methods
 general discussion 4:3047
 gross national product (GNP) 4:3049
 national economies 4:3049
 specific industrial sectors 4:3048, 4:3048f, 4:3049f
 United States economy 4:3047, 4:3047f
- inspection techniques
 chemical/petrochemical industry 4:3161
 defense systems 4:3162
 future developments 4:3162
 general discussion 4:3146
 historical background 4:3146
 importance 4:3147
 management strategies 4:3159
 marine environments 4:3162
 oil and gas industry 4:3160
 oil and gas pipelines
 background information 4:3157
 direct assessments 4:3303
 general discussion 4:3301
 hydrotests 4:3303
 inspection vehicles 4:3158, 4:3159t
 management strategies 4:3160
 pipeline inspections gauge (PIG) 4:3158
 power plants 4:3161, 4:3162f
 process methods
 acoustic emission 4:3156, 4:3157f
 dye penetrant (DPI) surface crack detection 4:3155
 electrical techniques 4:3155
 fiber optic sensors (FOS) 4:3156
 in-line inspection (ILI) 4:3157
 magnetic particle (MPI) surface crack detection 4:3155
 magnetic techniques 4:3155
 nondestructive testing/examination (NDT/E) 4:3148
 portable X-ray machines 4:3154
 radiological techniques 4:3154
 thermography 4:3156
 ultrasonic techniques 4:3150, 4:3151f, 4:3152f
 visual inspections 4:3149
 resolution and response times 4:3163r
 transportation systems 4:3162
 ultrasonic methods
 basic concepts 4:3150
 probe types 4:3150
 specialized ultrasonic systems 4:3152, 4:3153f
 thickness/depth measurements 4:3151f, 4:3152f
- metal–environment interaction effects
 chemical reactions 1:92
 crystal structure imperfections 1:94f
 environmental conditions 1:92, 1:95f
 general discussion 1:89
 metal heterogeneities 1:93, 1:93t, 1:94f
- metallic cultural heritage preservation
 archaeological metals 2:1159, 4:3310, 4:3311f, 4:3312f
 conservation strategies 4:3310
 handling concerns 4:3313–3314, 4:3314f
 historical metals 4:3313, 4:3313f
 modern metals 3:2458, 4:3313–3314
- monitoring techniques **4:3117–3166**
 bacteria monitoring techniques 4:3135
 benefits 4:3120
 chemical analyses 4:3133
 coupon testing 4:3125, 4:3126f
 definitions 4:3120
 electrical resistance (ER) probes
 fixed attachment probe 4:3128f
 general discussion 4:3127
 ring-pair spool 4:3128f
 spiral flush probe 4:3127f
 spiral wide tip probe 4:3127f
- electrochemical techniques
 alternating current (AC) impedance spectroscopy (ACIS) 4:3130
 electrochemical noise 4:3131
 field signature method (FSM) 4:3131, 4:3132f, 4:3133f
 galvanic current 4:3130
 linear polarization resistance (LPR) 4:3129, 4:3130f
 potential measurements 4:3128
 potentiodynamic/cyclic polarization 4:3129
 thin layer activation (TLA) 4:3133
- future developments 4:3145
 historical background 4:3124
 hydrogen production 4:3134
 industrial applications
 atmospheric corrosion 4:3145
 chemical/petrochemical industry 4:3139, 4:3139t, 4:3141f
 civil engineering projects 4:3145
 cooling water systems 4:3143
 desalination 4:3143
 nuclear waste storage 4:3145
 oil and gas industry 4:3135, 4:3136r
 pipelines 4:3144
 power generation industry 4:3140
 pulp and paper industry 4:3143
 transportation systems 4:3144
- power generation industry
 coal-fired boiler tube corrosion 4:3140, 4:3142f, 4:3143f
 flue gas outlet duct corrosion control 4:3142
- process parameters and conditions 4:3135
 proposal guidelines
 data management 4:3122
 economic factors 4:3121
 engineering considerations 4:3123
 general discussion 4:3121
 legislative guidelines 4:3123
 objectives 4:3121
 personnel management 4:3122
 standards 4:3123
 technique limitations 4:3122
 technique selection 4:3121

- spool pieces 4:3134
 survey response findings 4:3124t, 4:3125t
 test heat exchangers 4:3134
 predictive modeling 2:1630–1679
 basic concepts 2:1633
 boiling water reactors (BWRs)
 corrosion evolutionary path (CEP) 2:1672f
 crack depth modeling 2:1673f
 electrochemical corrosion potential (ECP) calculation 2:1670f, 2:1671f
 failure probabilities 2:1669
 predicted damage plot 2:1672f
 schematic diagram 2:1669f
 corrosion damage classifications 2:1633
 corrosion evolutionary path (CEP) 2:1632–1633, 2:1672f
 damage function analysis (DFA)
 basic concepts 2:1636, 2:1638f
 extreme value statistical analysis (EVS) 2:1661
 hyperbolic dependencies 2:1664f
 logarithmic law dependencies 2:1665f
 power law dependencies 2:1665f
 empirical versus deterministic models 2:1632
 general discussion 2:1669, 2:1676
 low-pressure steam turbine (LPST) study
 blade failure probabilities 2:1674t, 2:1675f
 disc failure probabilities 2:1674f, 2:1674t, 2:1675f
 general discussion 2:1673
 mixed potential model 2:1638, 2:1640f
 Monte Carlo (MC) simulation techniques 2:1665, 2:1667t, 2:1668f
 parameter values 2:1667t
 pit depth distributions 2:1636f
 pit depth measurements 2:1634t, 2:1668f
 pit nucleation rate
 empirical models 2:1641
 mean critical breakdown potential 2:1646f
 point defect model 2:1641, 2:1642f, 2:1645f, 2:1646f
 pit propagation rate
 calculation approaches 2:1648, 2:1657, 2:1658f
 coupled environment corrosion models 2:1652, 2:1653f, 2:1655f, 2:1656f
 general discussion 2:1648
 quasi-potential plot 2:1658f
 pit repassivation rate 2:1661
 pit-to-crack transition 2:1661
 process classifications
 existing classifications
 dry corrosion 1:97, 1:97f
 general discussion 1:96
 wet corrosion 1:97f, 1:98
 organic solvents 1:98, 1:98f
 spontaneous reactions 1:100t
 suggested classifications 1:99
 research approaches
 chemical reaction approach 1:92
 crystal structure imperfections 1:94f
 environmental conditions 1:92, 1:95f
 general discussion 1:91
 metal heterogeneities 1:93, 1:93t, 1:94f
 tribocorrosion 2:1005–1050
 water system modifications 4:2930–2970
 chemical inhibitors
 cooling systems 4:2964, 4:2965t, 4:2968f
 general discussion 4:2961
 steam boiler systems 4:2961
 closed-loop water systems 4:2943
 cooling systems 4:2964, 4:2965t, 4:2968f
 corrosion mechanisms
 concentrated cell/crevice corrosion 4:2947
 condensate line corrosion 4:2948
 crevice corrosion 2:766
 erosion 4:2948
 galvanic corrosion 4:2946
 general discussion 4:2945
 grooving corrosion 4:2948
 impingement attacks 4:2948
 microbially-induced corrosion (MIC) 4:2949, 4:2949f, 4:2967, 4:2969t
 pitting corrosion 4:2945, 4:2946f
 stress corrosion 4:2947
 uniform corrosion 4:2945
 white rust 4:2949
 heat capacity 4:2931
 importance 4:2931
 industrial heating and cooling systems
 alkalinity 4:2939, 4:2939t, 4:2940t, 4:2953, 4:2958
 bacterial growth count evaluation 4:2969t
 blistering 4:2958f
 chemical inhibitors 4:2961
 contaminant cycles of concentration (COC) 4:2959t, 4:2960, 4:2961t
 contaminant saturation conditions 4:2956
 cooling systems 4:2964, 4:2965t, 4:2968f
 corrosion mechanisms 4:2945
 corrosion mitigation 4:2933, 4:2936f
 corrosion monitoring 4:3143
 corrosion rate quantification 4:2957t
 corrosion test coupon 4:2956f
 corrosion vulnerability data 4:2956t
 freshwater consumption 4:2932, 4:2935f
 hardness 4:2940–2941, 4:2953, 4:2958
 hydrologic cycle 4:2936, 4:2937f
 Langelier saturation index (LSI) 4:2958
 Larson–Skold index (L–SI) 4:2960
 makeup water treatment 4:2959t
 metal and alloy materials selection 4:2955, 4:2956t
 microbially-induced corrosion (MIC) 4:2967, 4:2969t
 microbiological fouling 4:2950, 4:2950f, 4:2967, 4:2969t
 mineral scales, muds, and sludges 4:2941, 4:2942f, 4:2942t, 4:2943f
 organic inhibitors 4:2966, 4:2966f
 pathogenic bacteria 4:2951, 4:2951f
 pretreatment processes 4:2953, 4:2954f
 Puckorius scaling index (PSI) 4:2959
 Ryznar stability index (RSI) 4:2959
 scale formation 4:2935, 4:2936f
 steam boiler systems 4:2961
 treatment guidelines 4:2952
 water chemistry 4:2936, 4:2939t
 water treatment factors 4:2933
 latent heat 4:2932
 new-construction HVAC systems 4:2944
 organic inhibitors 4:2966, 4:2966f
 potable systems
 alkalinity 4:2939, 4:2939t, 4:2940t, 4:2953, 4:2958
 bacterial growth count evaluation 4:2969t
 blistering 4:2958f
 chemical inhibitors 4:2961
 contaminant cycles of concentration (COC) 4:2959t, 4:2960, 4:2961t
 contaminant saturation conditions 4:2956
 corrosion mechanisms 4:2945
 corrosion mitigation 4:2933, 4:2936f
 corrosion rate quantification 4:2957t
 corrosion test coupon 4:2956f
 corrosion vulnerability data 4:2956t
 freshwater consumption 4:2932, 4:2935f
 hardness 4:2940–2941, 4:2953, 4:2958
 hydrologic cycle 4:2936, 4:2937f
 Langelier saturation index (LSI) 4:2958
 Larson–Skold index (L–SI) 4:2960
 makeup water treatment 4:2959t
 metal and alloy materials selection 4:2955, 4:2956t
 microbially-induced corrosion (MIC) 4:2967, 4:2969t
 microbiological fouling 4:2950, 4:2950f, 4:2967, 4:2969t
 mineral scales, muds, and sludges 4:2941, 4:2942f, 4:2942t, 4:2943f
 pathogenic bacteria 4:2951, 4:2951f
 pretreatment processes 4:2953, 4:2954f
 Puckorius scaling index (PSI) 4:2959
 Ryznar stability index (RSI) 4:2959
 scale formation 4:2935, 4:2936f
 treatment guidelines 4:2952
 water chemistry 4:2936, 4:2939t
 water treatment factors 4:2933
 steam boiler systems 4:2961

- corrosion fatigue 2:928–953
 airframe corrosion 4:3178, 4:3178r
 alloys
 aluminum alloys 2:947, 2:948f
 carbon steel 3:2457
 ferrous alloys 2:944
 stainless steels 2:946, 2:946r
 titanium alloys 2:948
 aluminum alloys 3:1995, 3:1996f
 basic concepts
 crack growth rate–crack size plot 2:931f
 crack growth stages 2:931f
 general discussion 2:930
 initiation sites 2:931f
 persistent slip bands 2:931f
 cast iron
 curve plots 3:1770f, 3:1771f
 fatigue resistance 3:1770r, 3:1771f, 3:1772f
 general discussion 3:1768
 limiting strengths 3:1769r
 characteristics 1:95r
 corrosion management 4:3010
 corrosion test methods 2:1491, 2:1492f
 general discussion 2:950
 historical background 2:929
 influencing factors
 damage regimes 2:937r
 electrochemical conditions 2:942, 2:943f
 general discussion 2:940
 intermetallic particles 2:941
 loading frequency 2:941, 2:942f
 microstructure 2:941
 solution conditions 2:942
 stress state 2:944, 2:944f
 surface conditions 2:942, 2:943f
 loading patterns 2:858f
 low-pressure steam turbine (LPST) modeling study 2:1674r
 magnesium alloys 3:2028
 mechanical fasteners 3:2449
 nitric acid (HNO₃) solutions 2:1258
 photographic illustration 4:3104f
 prevention strategies
 barrier coatings 2:949
 cathodic protection 2:950
 general discussion 2:949
 surface treatments 2:950
 regimes and mechanisms
 damage regimes 2:937r
 general discussion 2:932
 long crack growth
 basic concepts 2:938
 corrosion fatigue models 2:940
 linear elastic fracture mechanics (LEFMs) analysis 2:938, 2:939f, 2:940
 short crack growth
 development stages 2:932, 2:932f, 2:933f
 initiation stage 2:932, 2:937r
 linear elastic fracture mechanics (LEFMs) analysis 2:935
 loading frequency 2:941, 2:942f
 passive film breakdown 2:933
 pit–crack transition 2:935, 2:936f, 2:937f, 2:937r
 pit formation 2:933
 pit growth rate 2:934, 2:935f, 2:937r
 pitting corrosion fatigue models 2:938, 2:938r
 short crack–long crack interface 2:935, 2:937f, 2:937r
 surface film breakdown 2:934
 transition stages 2:933f
 S–N (stress–number of cycles to failure) curves 2:930f
 stainless steels 2:1258, 3:1836
 surgical implants 2:1318
 corrosion ladder 3:2361
 corrosion management 4:3001–3039
 basic concepts 4:3005
 catastrophic incidents 4:3035
 definitions 4:3003
 effectiveness 4:3034
 environmental modifications 4:2891–2899
 corrosion control strategies 4:2891
 corrosion rates 4:2898f
 corrosive agent removal (CAR)
 basic concepts 4:2892
 electrochemical reactions 4:2892f
 gaseous environments 4:2892
 liquid environments 4:2893, 4:2894f
 general discussion 4:2899
 protective barrier inducement (PBI)
 aqueous acidic solutions 4:2895, 4:2896f, 4:2897f
 aqueous near-neutral solutions 4:2897, 4:2898f, 4:2899f
 basic concepts 4:2894
 corrosion inhibitors 4:2895, 4:2896f, 4:2897f
 general discussion 4:3002
 importance 4:3002
 infrastructure systems 4:3198–3206
 background information 4:3198
 degradation mechanisms 4:3198
 failure consequences 4:3199
 highway infrastructure 4:3200f, 4:3201f, 4:3202f, 4:3203
 inspection requirements
 bridge half-joint diagram 4:3200f
 electromagnetic covermeter 4:3202f
 half-cell potential surveys 4:3201, 4:3202f
 importance 4:3199
 inspection equipment 4:3201f, 4:3202f
 methodologies 4:3200
 remote monitoring methods 4:3203
 structural factors 4:3203
 lighting and signage posts 4:3205
 parking structures 4:3204, 4:3205f
 key performance indicators (KPIs) 4:3240, 4:3005–3006, 4:3030, 4:3266r, 4:3265
 legislative regulations 4:3003, 4:3004r
 management processes
 general discussion 4:3006
 management requirements 4:3007f
 quality management processes 4:3238, 4:3006
 risk management processes
 basic concepts 4:3007
 information flow guidelines 4:3009, 4:3009f
 process flowchart 4:3008f
 risk analysis, mitigation, and control flowchart 4:3010f
 management systems
 asset management systems 4:3036–3037, 4:3037f
 data management systems 4:3032, 4:3034f
 frameworks
 corrosion management systems 4:3026, 4:3027f, 4:3028f
 risk mitigation systems 4:3025, 4:3026f
 key performance indicators (KPIs) 4:3030
 management tools
 corrosion mitigation requirements
 basic concepts 4:3022
 data management systems 4:3024, 4:3025f
 mitigation flowchart 4:3022f
 monitoring techniques 4:3023, 4:3024f, 4:3117–3166
 probability analysis
 basic concepts 4:3018
 corrosion rates 4:3019f
 failure probabilities 4:3021f
 inhibitor performance analysis 4:3020r
 quantitative corrosion risk analysis 4:3020f
 risk assessment guidelines
 control options 4:3016r
 criticality assessments 4:3013, 4:3014r, 4:3015r
 failure probabilities 4:3017f, 4:3018r
 hazards identification 4:3012, 4:3013r
 matrix analyses 4:3013, 4:3014r
 risk-based inspection (RBI) 4:3238–3239, 4:3016, 4:3016f, 4:3017f
 risk identification
 corrosion sources 4:3011
 damage and failure modes 4:3010
 risk assessment flowchart 4:3012f
 mining industry 4:2994
 oil and gas industry 4:3230–3269

- chemical injection systems
 - carbon dioxide (CO₂)/hydrogen sulfide (H₂S) content 4:3260
 - common treatments 4:3260
 - inhibitor residuals 4:3261
 - iron counts 4:3261
 - oxygen monitoring 4:3261
 - pH measurements 4:3261
 - temperature/pressure measurements 4:3260
- chemical treatments 4:2900–2929
 - batch treatments 4:2907*f*, 4:2907
 - continuous treatments 4:2906*f*, 4:2905
 - corrosion inhibition 4:2908
 - corrosion reactions 4:2902*f*, 4:2901
 - data management strategies 4:2928*f*, 4:2927
 - emulsion cleaners 4:2905*f*, 4:2903
 - field applications 4:2905
 - inhibition risk evaluation/mitigation monitoring 4:2926*t*, 4:2925
 - inhibitors 4:2905*f*, 4:2903
 - injection failures 4:2906*f*, 4:2906
 - microbially-induced corrosion (MIC) 4:2922*f*, 4:2920
 - pipelines 4:2902*f*
 - program management strategies 4:2924*f*, 4:2925*t*, 4:2923
 - scale inhibition/control 4:2916
 - squeeze treatments 4:2907*f*, 4:2907–2908
 - treating terminology 4:2903
- communication and management structure
 - audit/compliance reviews 4:3266
 - contractual structure 4:3265
 - corrosion management team 4:3264
 - key performance indicators (KPIs) 4:3266*t*, 4:3265
 - management of change (MoC) procedures 4:3265
 - ongoing improvement practices 4:3266
- corrosion inhibition
 - adsorption inhibition processes 4:2909*f*, 4:2910*f*, 4:2908
 - chemical treatments 4:2902*f*, 4:2903
 - general discussion 4:2908
 - inhibitor performance analysis 4:2910*f*, 4:2910
 - inhibitor testing 4:2911
- corrosion threat characteristics 4:3233, 4:3235*f*
- design guidelines
 - commissioning procedures 4:3255
 - data management systems 4:3255
 - documentation 4:3250
 - engineering considerations 4:3253
 - general discussion 4:3250
- documentation guidelines
 - cathodic protection (CP) systems 4:3253
 - chemical injection systems 4:3251
 - corrosion management philosophy 4:3251
 - material selection reports 4:3250, 4:3252*f*
- engineering considerations
 - corrosion allowances 4:3253
 - corrosion threat minimization 4:3253, 4:3254*f*
 - inaccessible pipework 4:3253
 - insulation 4:3254
 - pigging facilities 4:3254
- fabrication/construction guidelines
 - commissioning procedures 4:3256
 - integrity management systems 4:3256
 - quality assurance (QA)/quality control (QC) 4:3255
- Front End Engineering Design (FEED)
 - basic concepts 4:3243
 - corrosion risk analysis 4:3247, 4:3247*f*
 - data availability 4:3244
 - financial projections 4:3247*f*
 - installation and operational considerations 4:3248, 4:3250*f*
 - laboratory tests 4:3247
 - modeling approaches 4:3244, 4:3245*f*, 4:3246*f*
 - procurement considerations 4:3248
 - quality assurance (QA) practices 4:3248
 - risk matrices 4:3247, 4:3247*f*
- general discussion 4:3233, 4:3267
- industry drivers and changes 4:3238
- inhibitor testing
 - autoclave tests 4:2914
 - bubble tests 4:2911
 - compatibility tests 4:2915*f*, 4:2914
 - field deployment tests 4:2914
 - general discussion 4:2911
 - jet impingement tests 4:2914
 - persistence tests 4:2913*f*, 4:2913
 - rotating cylinder electrode (RCE)/flow loops tests 4:2912*f*, 4:2912
 - weld corrosion 4:2914*f*, 4:2915*f*, 4:2914
- inspection techniques 4:3160
- management process guidelines 4:3240, 4:3242*f*
- microbially-induced corrosion (MIC)
 - bacteria monitoring techniques/serial dilution 4:2922*f*, 4:2920
 - biocide application procedures 4:2922
 - biocide treatments 4:2922
 - corrosion effects 4:2922*f*, 4:2920
- mitigation approaches
 - pipelines 4:3236–3237
 - process plants 4:3238
 - subsurface environments 4:3236
- monitoring techniques
 - background information 4:3121, 4:3124
 - case studies 4:3138
 - economic factors 4:3136*t*
 - field signature method (FSM) 4:3131, 4:3132*f*, 4:3133*f*
 - general discussion 4:3135
 - survey response findings 4:3124*t*
- operations phase
 - chemical injection systems 4:3260
 - communication and management structure 4:3264
 - corrosion management strategy implementation 4:3257
 - data management systems 4:3261
 - direct assessment (DA) procedures 4:3263
 - external protection 4:3260
 - fitness-for-service (FFS) assessments 4:3264
 - inspection and monitoring activities 4:3259*f*, 4:3257
 - process condition changes 4:3262
 - risk-based inspection (RBI) 4:3263
- pipelines
 - components 4:3236
 - corrosion characteristics 4:3236
 - in-line inspection (ILI) 4:3157, 4:3301
 - pipeline inspections gauge (PIG) 4:3158
- process plants
 - components 4:3237
 - corrosion characteristics 4:3237
 - risk-based inspection (RBI) 4:3238–3239, 4:3263
 - scale inhibition/control
 - chemical treatments 4:2917*t*, 4:2916
 - control mechanisms 4:2917
 - general discussion 4:2916
 - inhibitor material selection 4:2919
 - inhibitor treatments 4:2916
 - removal methods 4:2919
 - scale formation 4:2916*f*
 - scale prediction models 4:2919*f*, 4:2917
 - squeeze treatments 4:2921*f*, 4:2919
 - subsurface environments
 - components 4:3235
 - corrosion characteristics 4:3235
- pipelines 4:3270
 - cathodic protection
 - basic concepts 4:3287
 - close interval potential surveys (CIPSs) 4:3290
 - design criteria 4:3288
 - impressed current anodes 4:3288, 4:3288*f*
 - internal protection 4:2812*t*, 4:2826, 4:2827*f*
 - monitoring procedures 4:3289
 - sacrificial anodes 4:3287, 4:3287*f*
 - shielding criteria 4:3289
 - system criteria 4:3288, 4:3289*f*
 - coatings
 - alternating current (AC) monitoring surveys 4:3286
 - coating failures 4:3284
 - coating requirements 4:3281
 - coating types 4:3283, 4:3283*r*
 - condition monitoring 4:3285
 - direct current voltage gradient (DCVG) surveys 4:3285
 - field joint coatings 4:3284

- corrosion management (*continued*)
- direct assessments
 - external corrosion direct assessment (ECDA) 4:3304
 - general discussion 4:3303
 - internal corrosion direct assessment (ICDA) 4:3304
 - stress corrosion cracking direct assessment (SCCDA) 4:3304
 - external corrosion risks
 - alternating current (AC) corrosion 4:3281
 - cathodic protection 4:3287
 - coatings 4:3281
 - corrosion mechanisms 4:3277
 - direct assessment techniques 4:3304
 - microbially-induced corrosion (MIC) 4:3279
 - preferential corrosion 4:3280
 - prevention strategies 4:3281
 - risk assessment guidelines 4:3290, 4:3291*r*
 - soil corrosion 4:3278, 4:3278*f*
 - stray-current corrosion 4:3280, 4:3280*f*
 - in-line inspection (ILI)
 - advantages 4:3303
 - crack detection 4:3302
 - general discussion 4:3301
 - magnetic flux leakage (MFL) 4:3302
 - ultrasonic wall thickness measurements 4:3302, 4:3302*f*
 - inspection techniques
 - direct assessments 4:3303
 - general discussion 4:3301
 - hydrotests 4:3303
 - in-line inspection (ILI) 4:3301
 - internal corrosion risks
 - carbon dioxide (CO₂) corrosion 4:3291
 - coatings 4:3296
 - corrosion allowance 4:3295
 - corrosion-resistant alloys 4:3296
 - direct assessment techniques 4:3304
 - general discussion 4:3290
 - inhibitors 4:3296
 - localized corrosion 4:3293
 - microbially-induced corrosion (MIC) 4:3295
 - monitoring procedures 4:3297
 - prevention strategies 4:3295
 - product treatments 4:3296
 - risk assessment guidelines 4:3298, 4:3298*r*
 - sour corrosion 4:3294
 - sweet corrosion 4:3291
 - localized corrosion
 - flow-induced localized corrosion (FILC) 4:3293
 - general discussion 4:3293
 - mesa corrosion 4:3293
 - pitting corrosion 4:3293
 - preferential weld corrosion 4:3293
 - monitoring techniques 4:3144
 - pipeline integrity management 4:3277, 4:3277*f*, 4:3305
 - prevention strategies
 - cathodic protection 4:2812*r*, 4:2826, 4:2827*f*, 4:3287
 - coatings 4:3281, 4:3283*r*, 4:3296
 - corrosion allowance 4:3295
 - corrosion-resistant alloys 4:3296
 - inhibitors 4:3296
 - internal corrosion risks 4:3295
 - product treatments 4:3296
 - significance
 - cost concerns 4:3273
 - failure causes 4:3273, 4:3274*r*
 - pipeline age-spill frequency relationship 4:3275*f*
 - pipeline failure statistics 4:3273, 4:3274*r*
 - safety concerns 4:3276, 4:3276*r*
 - sour corrosion
 - general discussion 4:3294
 - hydrogen-induced cracking (HIC) 4:3294, 4:3295*f*
 - materials selection 4:3295
 - stress-oriented HIC 4:3295
 - sulfide stress corrosion cracking (SSCC) 4:3294
 - stress corrosion cracking (SCC) risks
 - characteristics 4:3299
 - direct assessment techniques 4:3304
 - external corrosion risks 4:3299
 - high-pH stress corrosion cracking 4:3299
 - near-neutral pH stress corrosion cracking 4:3300
 - occurrence 4:3299
 - risk assessment guidelines 4:3301
 - sweet corrosion
 - basic concepts 4:3291
 - flow rate effects 4:3292
 - hydrogen sulfide (H₂S) content effects 4:3293
 - partial pressure effects 4:3292
 - pH effects 4:3292
 - temperature effects 4:3292
 - Swiss cheese hazard management model 4:3239–3240, 4:3035–3036, 4:3035*f*
 - corrosion-resistant alloys
 - body fluids 2:1308–1322
 - biological components 2:1311
 - biomedical devices
 - cobalt–chromium–molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
 - corrosion fatigue 2:1318, 3:2049
 - corrosion types 2:1316
 - crevice corrosion 2:1317
 - dental amalgams 2:1316
 - fretting corrosion 2:1318
 - galvanic corrosion 2:1319
 - general corrosion 2:1316
 - general discussion 2:1319
 - health effects 2:1310, 2:1310*r*
 - historical background 2:1308
 - hydrogen embrittlement 2:1317
 - magnesium alloys 2:1315
 - metallic foams 2:1315
 - nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
 - pitting corrosion 2:1317
 - porous materials 2:1315
 - rare earth magnets 2:1310, 2:1316
 - stainless steels 2:764, 2:1314
 - stress corrosion cracking (SCC) 2:1317
 - surface finish 2:1313
 - titanium nitride (TiN) coatings 2:1316
 - titanium/titanium alloys 2:764, 2:1310, 2:1313, 2:1317, 3:2049, 3:2164
 - environmental conditions 2:1311, 2:1312*f*
 - health effects 2:1310, 2:1310*r*
 - metal ion concentrations 2:1310*r*
 - niobium (Nb) 3:2148
 - oxygen–carbon dioxide level comparisons 2:1311–1312, 2:1312*r*
 - safety concerns 2:1308
 - tantalum (Ta) 3:2148
- corrosion types
 - corrosion fatigue 2:944, 2:1318, 3:2049
 - crevice corrosion 2:1317
 - fretting corrosion 2:1318
 - galvanic corrosion 2:1319
 - general corrosion 2:1316
 - hydrogen embrittlement 2:1317
 - pitting corrosion 2:1317
 - stress corrosion cracking (SCC) 2:1317
- dental fixtures
 - amalgams 2:1316
 - health effects 2:1310, 2:1310*r*
 - historical background 2:1308
 - nickel titanium (NiTi) alloys 2:1314
 - rare earth magnets 2:1310, 2:1316
 - safety concerns 2:1308
 - stainless steels 2:1314
 - titanium/titanium alloys 3:2049
- design requirements 1:541–557
 - carburation 1:551
 - environment-based alloy selection 1:549
 - free energies 1:542*f*
 - general discussion 1:555
 - high-temperature environments 1:541
 - nitridation processes 1:549, 1:550*f*, 1:551*f*
 - oxidation lifetime maximization 1:547, 1:548*f*
 - protective oxidation 1:542, 1:542*f*, 1:543*f*
 - rare earth element additions 1:546, 1:546*f*, 1:547*f*
 - scale adhesion 1:546, 1:546*f*, 1:547*f*

- scale formation 1:543, 1:543f, 1:545f
selective oxidation 1:543, 1:543f, 1:545f
steady-state oxidation 1:546
sulfidation corrosion 1:551–552, 1:552f, 1:554f
thermal expansion coefficients 1:548f
water vapor effects 1:553, 1:553t, 1:554f
- molybdenum additives 3:2159
- nickel (Ni)
alloy 59
acetic acid production 3:1908
corrosion loss diagram 3:1888f
corrosion rates 3:1889f, 3:1905f, 3:1911f
corrosion resistance 3:1887, 3:1900
fine and specialty chemicals 3:1910
hydrochloric acid (HCl) isocorrosion diagram 3:1888f
hydrofluoric acid (HF) production 3:1907
major alloying elements 3:1881t
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
phosphoric acid (H₃PO₄) production 3:1906f
pitting resistance 3:1894f
pollution controls 3:1912
sulfuric acid (H₂SO₄) isocorrosion diagram 3:1888f
sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904f, 3:1905f
tank transport studies 3:1912
thermal stability 3:1890t, 3:1891f
time–temperature–sensitization diagram 3:1891f
toluene di-isocyanate (TDI) 3:1909
vinyl chloride monomer (VCM) production 3:1908
- alloy 625
acrylic acid/acrylate ester production 3:1909
corrosion loss diagram 3:1888f
corrosion rates 3:1889f
corrosion resistance 3:1890, 3:1899
galvanic corrosion 2:849f
major alloying elements 3:1881t
nuclear waste isolation 2:767
phosphoric acid (H₃PO₄) production 3:1905
pitting resistance 3:1894f, 3:1900
sulfuric acid (H₂SO₄) isocorrosion diagram 2:1243f
thermal expansion coefficients 1:145f
time–temperature–sensitization diagram 3:1891f
vinyl chloride monomer (VCM) production 3:1908
- alloy 31
acetic acid production 3:1908
acrylic acid/acrylate ester production 3:1909
corrosion loss measurements 3:1894t, 3:1895t
corrosion rates 3:1905f, 3:1911f
corrosion resistance 3:1892, 3:1900
fine and specialty chemicals 3:1910
historical development 3:1882t
hydrochloric acid (HCl) isocorrosion diagram 3:1894f
major alloying elements 3:1881t
phosphoric acid (H₃PO₄) production 3:1905, 3:1906f
pitting potential 3:1895f
pitting resistance 3:1894f, 3:1897t, 3:1900, 3:1901t
pollution controls 3:1912
stability limits 3:1895f
sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237f, 3:1893f
sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904f, 3:1905f
tank transport studies 3:1912
- alloy 33
caustic soda (NaOH) production 3:1902, 3:1902f
corrosion loss measurements 3:1896t, 3:1897t
corrosion resistance 3:1892, 3:1896f
historical development 3:1882t
major alloying elements 3:1881t
pitting resistance 3:1894f, 3:1897t
sulfuric acid (H₂SO₄) environments 2:1238f
sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897f
sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 400
acrylic acid/acrylate ester production 3:1909
alkali corrosion 2:1200f
hydrofluoric acid (HF) production 2:1214f, 3:1907
marine environments 2:1135, 2:1136t
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
oxidizing environments 2:1240f
styrene production 3:1908
sulfuric acid (H₂SO₄) environments 2:1247f
velocity factors 2:1241f
vinyl chloride monomer (VCM) production 3:1908
- alloy 926
acrylic acid/acrylate ester production 3:1909
corrosion loss measurements 3:1894t, 3:1895t
hydrofluoric acid (HF) production 3:1907
phosphoric acid (H₃PO₄) production 3:1906f
pitting potential 3:1895f
pitting resistance 3:1894f, 3:1897t
pollution controls 3:1914
stability limits 3:1895f
styrene production 3:1908
vinyl chloride monomer (VCM) production 3:1908
- alloy C-276
acetic acid production 3:1908
acrylic acid/acrylate ester production 3:1909
corrosion loss diagram 3:1888f
corrosion rates 3:1889f
corrosion resistance 3:1886, 3:1900
galvanic corrosion 2:849f
hydrofluoric acid (HF) production 3:1907
major alloying elements 3:1881t
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
phosphoric acid (H₃PO₄) production 3:1906f
pitting resistance 3:1894f, 3:1900
pollution controls 3:1912
styrene production 3:1908
sulfuric acid (H₂SO₄) environments 2:1238f, 2:1240f, 2:1243f
sulfuric acid (H₂SO₄) isocorrosion diagram 3:1887f
sulfuric acid (H₂SO₄) production and handling 3:1903
thermal expansion coefficients 1:145f
thermal stability 3:1890t
time–temperature–sensitization diagram 3:1891f
toluene di-isocyanate (TDI) 3:1909
vinyl chloride monomer (VCM) production 3:1908
- aqueous corrosive environments 3:1879–1915
acetic acid production 3:1907
acrylic acid/acrylate ester production 3:1909
age-hardenable nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
alloy 28 3:1894t, 3:1895f, 3:1895t, 3:1896t, 3:1897t, 3:1905
alloy 39 3:1911f
alloy 200 3:1902, 3:1908
alloy 201 3:1902, 3:1902f
alloy 316 2:1238f, 2:1247f, 3:1897t
alloy 600 2:1136t, 3:1902, 3:1908
alloy 617 3:1908
alloy 690 2:1238f, 3:1896t
alloy 800 2:1136t, 3:1908
alloy 904L 2:1238f, 3:1897t, 3:1906f, 4:3059t, 4:3060f
alloy B-2 2:1238f, 2:1240f, 3:1903, 3:1907, 3:1908, 3:1909, 3:1911f, 4:3058f
background information 3:1881
caustic soda (NaOH) production 3:1902
chemical process industry and environmental technology 3:1901
fine and specialty chemicals 3:1910
general discussion 3:1880
heat-affected zone (HAZ) 3:1898, 3:1898f
historical development 3:1882t
hydrofluoric acid (HF) production 3:1907
intercrystalline corrosion (IC) 3:1894–1895, 3:1900
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1881, 3:1881t, 3:1882t, 3:1891
nickel–chromium–molybdenum (Ni–Cr–Mo) alloys 3:1881, 3:1881t, 3:1882t, 3:1886
nickel–chromium (Ni–Cr) alloys 3:1881, 3:1881t, 3:1882t, 3:1885, 3:1886f
nickel–copper (Ni–Cu) alloys 2:1119f, 3:1881, 3:1881t, 3:1882t, 3:1883
nickel–molybdenum (Ni–Mo) alloys 3:1881, 3:1881t, 3:1882t, 3:1884, 3:1885f
phosphoric acid (H₃PO₄) production 3:1905

- corrosion-resistant alloys (*continued*)
- pitting resistance 3:1900
 - pollution controls 3:1912
 - principal alloys 3:1881, 3:1881*t*
 - styrene production 3:1908
 - sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 - surface conditions and treatment 3:1899
 - tank transport studies 3:1912
 - toluene di-isocyanate (TDI) 3:1909
 - vinyl chloride monomer (VCM) production 3:1886–1887, 3:1908
 - welded-state corrosion behavior 3:1898
 - nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
 - alloy 20 2:831*f*, 2:1119*f*, 2:1128*t*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*
 - alloy 825 2:767, 2:1238*f*, 2:1243*f*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*, 3:1908
 - alloy G-3 3:1881*t*, 3:1882*t*, 3:1891, 3:1894*t*, 3:1907
 - alloy G-30 2:1238*f*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1896*t*
 - corrosion resistance 3:1891
 - historical development 3:1882*t*
 - major alloying elements 3:1881, 3:1881*t*
 - nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 - alloy 22 2:767, 3:1881*t*, 3:1887, 3:1888*f*, 3:1890*t*, 3:1891*f*
 - alloy 686 3:1881*t*, 3:1889, 3:1890, 3:1891*f*
 - alloy 2000 2:1241*f*, 2:1247*f*, 3:1881*t*, 3:1889, 3:1890, 3:1891*f*
 - alloy C-4 1:145*f*, 3:1881*t*, 3:1887, 3:1888*f*, 3:1891*f*, 3:1900
 - alloy MAT 21 3:1881*t*, 3:1889
 - corrosion resistance 3:1886
 - general discussion 3:1886
 - historical development 3:1882*t*
 - hydrochloric acid (HCl) corrosion 2:1215*f*, 2:1216*f*
 - hydrofluoric acid (HF) corrosion 2:1214*f*
 - intergranular corrosion 2:819
 - major alloying elements 3:1881, 3:1881*t*
 - nickel–chromium (Ni–Cr) alloys
 - corrosion resistance 3:1885, 3:1886*f*, 3:1900
 - historical development 3:1882*t*
 - internal nitridation processes 1:308–309, 1:309*f*
 - major alloying elements 3:1881, 3:1881*t*
 - nickel–copper (Ni–Cu) alloys
 - corrosion resistance 3:1883
 - historical development 3:1882*t*
 - major alloying elements 3:1881, 3:1881*t*
 - phase diagram 1:64*f*
 - stress corrosion cracking (SCC) 2:867*t*
 - nickel–molybdenum (Ni–Mo) alloys
 - corrosion resistance 3:1884, 3:1885*f*
 - historical development 3:1882*t*
 - major alloying elements 3:1881, 3:1881*t*
 - time–temperature–notch impact energy diagram 3:1885*f*
 - pipeline corrosion management 4:3296
 - stress corrosion cracking (SCC) 2:867*t*
 - titanium/titanium alloys 3:2049
 - see also* aircraft corrosion
- corrosion-resistant construction materials *see* ceramics
- corrosion testing 2:1443–1526
- accelerated testing
 - electrolytic tests
 - electrochemical tests 2:1483, 2:1484*f*
 - electrolytic corrosion (EC) test 2:1472, 2:1472*t*
 - electrolytic oxalic acid etching test 2:1472, 2:1483, 2:1483*f*, 2:1484*f*
 - general discussion 2:1471
 - impedance (Aztac) test 2:1472
 - simulated environments
 - Corrodokote test 2:1473
 - spray tests 2:1472, 2:1473*f*
 - sulfur dioxide (SO₂) tests 2:1474
 - test result considerations 2:1475
 - weathering steels 2:1475, 2:1476*f*, 2:1477*f*
 - atmospheric galvanic tests 2:1503, 2:1504*f*, 2:1505*f*, 2:1506*f*
 - atmospheric tests 2:1502
 - bimetallic corrosion 2:1470
 - cavitation–erosion 2:1493, 2:1494*f*
 - corrosion fatigue 2:1491, 2:1492*f*
 - corrosion inhibitors
 - immersed conditions 2:1511, 2:1512*f*
 - vapor phase conditions 2:1513
 - crevice corrosion 2:1486, 2:1488*f*, 2:1488*t*, 2:1489*f*
 - electrochemical measurements
 - corrosion potential 2:1465
 - electrochemical cells 2:1463, 2:1464*f*, 2:1465*f*
 - general discussion 2:1462
 - instrumentation 2:1463
 - measurement techniques 2:1462
 - erosion corrosion 2:1489, 2:1490*f*
 - ferritic stainless steels 2:1486
 - fretting corrosion 2:1495
 - impingement attacks 2:1489, 2:1490*f*
 - laboratory corrosion tests
 - alternating-immersion tests 2:1460
 - heat-flux effects 2:1461, 2:1461*f*
 - testing solution composition 2:1462
 - total-immersion tests
 - aeration control 2:1456, 2:1456*f*
 - characteristics 2:1455
 - solution composition 2:1455
 - specimen support 2:1460
 - temperature control 2:1456
 - testing solution volume 2:1460
 - velocity effects 2:1457, 2:1457*f*, 2:1459*f*
 - water-line tests 2:1460
 - liquid metals/fused salts
 - chemical reactions 2:1496
 - general discussion 2:1495
 - impurity reactions 2:1496
 - liquid–metal embrittlement 2:1500
 - mass transfer 2:1496
 - simple solutions 2:1496
 - testing methods
 - dynamic tests 2:1498
 - general discussion 2:1497
 - loop tests 2:1498, 2:1498*f*
 - refluxing capsules 2:1497
 - static tests 2:1497
 - natural waters 2:1506, 2:1507*f*
 - nickel–iron–chromium (Ni–Fe–Cr) alloys
 - electrochemical potentiokinetic reactivation (EPR) test
 - basic concepts 2:1485, 2:1486*f*
 - double loop EPR test 2:1485
 - reactivation ratio EPR test 2:1485
 - single loop EPR test 2:1485
 - intragranular corrosion
 - background information 2:1478
 - boiling nitric acid (HNO₃) test (Huey test) 2:1478, 2:1479*t*, 2:1480*f*
 - boiling sulfuric acid/copper sulfate (H₂SO₄/CuSO₄) tests 2:1479*t*, 2:1480*f*, 2:1481, 2:1482*f*
 - electrochemical potentiokinetic reactivation (EPR) test 2:1485, 2:1486*f*
 - electrochemical tests 2:1483, 2:1484*f*
 - electrolytic oxalic acid etching test 2:1483, 2:1483*f*, 2:1484*f*
 - maximum acceptable evaluation test rates 2:1480*t*
 - nitric acid–hydrofluoric acid (HNO₃–HF) test 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
 - sulfuric acid–iron sulfate (H₂SO₄–FeSO₄) test (Streicher test) 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
 - test potentials 2:1480*f*
 - test summary 2:1479*t*
 - organic coatings
 - coating behavior 2:1508
 - coating evaluations
 - abrasion tests 2:1511
 - distensibility 2:1511
 - general discussion 2:1510
 - hardness 2:1511
 - impact tests 2:1511
 - exposure conditions
 - field and plant tests 2:1510
 - general discussion 2:1509
 - laboratory tests 2:1509

- general discussion 2:1508
 laboratory tests
 adherence tests 2:1510
 electrochemical tests 2:1509
 exposure cabinets 2:1510
 general discussion 2:1509
 specimen preparation techniques 2:1509
 polarization resistance
 applications 2:1467
 basic concepts 2:1466
 linear polarization resistance method derivation 2:1468
 polarization rate (R_p) 2:1469, 2:1469*f*
 Tafel constants 2:1467
 Tafel slope and corrosion rate determinations 2:1469, 2:1469*f*
 soil corrosion 2:1471, 2:1507
 stainless steels
 in-service corrosion rates 2:1267
 ranking tests 2:1267
 test characteristics 2:1445
 test procedures
 corrosion product removal 2:1454
 corrosion rate–penetration relationship 2:1453*r*
 damage appraisal 2:1451, 2:1453*r*
 exposure duration 2:1449, 2:1450*f*
 fusion weld tests 2:1448
 heat treatments 2:1450
 replicate specimen quantity 2:1448
 specimen identification methods 2:1448
 stress effects 2:1451
 surface preparation 2:1446
 tests in plant
 corrosion racks 2:1501, 2:1501*f*
 general discussion 2:1500
 specimens 2:1502
 wood corrosivity 2:1326
 corrosive agent removal (CAR)
 basic concepts 4:2892
 electrochemical reactions 4:2892*f*
 gaseous environments 4:2892
 liquid environments 4:2893, 4:2894*f*
 corrosive environments 1:399–406
 aqueous corrosive environments 3:1879–1915
 age-hardenable nickel–chromium–iron–molybdenum–copper
 (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
 alloy 28
 corrosion loss measurements 3:1894*t*, 3:1895*t*, 3:1896*t*,
 3:1897*t*
 phosphoric acid (H₃PO₄) production 3:1905
 pitting potential 3:1895*f*
 alloy 200 3:1902, 3:1908
 alloy 201 3:1902, 3:1902*f*
 alloy 316 2:1238*f*, 2:1247*f*, 3:1897*t*
 alloy 39 3:1911*f*
 alloy 400
 acrylic acid/acrylate ester production 3:1909
 hydrofluoric acid (HF) production 2:1214*f*, 3:1907
 marine environments 2:1135, 2:1136*t*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 oxidizing environments 2:1240*f*
 styrene production 3:1908
 sulfuric acid (H₂SO₄) environments 2:1247*f*
 velocity factors 2:1241*f*
 vinyl chloride monomer (VCM) production 3:1908
 alloy 600 3:1902, 3:1908
 alloy 617 3:1908
 alloy 690 3:1896*t*
 alloy 800 3:1908
 alloy 904L 2:1238*f*, 3:1897*t*, 3:1906*f*
 alloy 926
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 hydrofluoric acid (HF) production 3:1907
 phosphoric acid (H₃PO₄) production 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*
 pollution controls 3:1914
 stability limits 3:1895*f*
 styrene production 3:1908
 vinyl chloride monomer (VCM) production 3:1908
 alloy B-2 2:1238*f*, 3:1903, 3:1907, 3:1908, 3:1909, 3:1911*f*
 background information 3:1881
 chemical process industry and environmental technology
 acetic acid production 3:1907
 acrylic acid/acrylate ester production 3:1909
 caustic soda (NaOH) production 3:1902
 fine and specialty chemicals 3:1910
 general discussion 3:1901
 hydrofluoric acid (HF) production 3:1907
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 phosphoric acid (H₃PO₄) production 3:1905
 pollution controls 3:1912
 styrene production 3:1908
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*,
 3:1905*f*
 tank transport studies 3:1912
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1908
 corrosion management 4:3162
 corrosion resistance 3:1882, 3:1883*f*
 general discussion 3:1880
 historical development 3:1882*t*
 modeling approaches 2:1585–1629
 basic concepts 2:1586
 general discussion 2:1626
 kinetic models 2:1600
 practical applications 2:1624
 thermodynamic models 2:1587
 nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu)
 alloys
 alloy 20 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*
 alloy 31 3:1892
 alloy 33 3:1892
 alloy 825 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*, 3:1908
 alloy G-3 3:1881*t*, 3:1882*t*, 3:1891, 3:1894*t*, 3:1907
 alloy G-30 3:1881*t*, 3:1882*t*, 3:1891, 3:1896*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 alloy 22 3:1881*t*, 3:1887, 3:1888*f*, 3:1890*t*, 3:1891*f*
 alloy 59 3:1887
 alloy 625 3:1881*t*, 3:1888*f*, 3:1889*f*, 3:1890, 3:1891*f*, 3:1894*f*, 3:1899
 alloy 686 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
 alloy 2000 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
 alloy C-4 3:1881*t*, 3:1887, 3:1888*f*, 3:1891*f*, 3:1900
 alloy C-276 3:1886
 alloy MAT 21 3:1881*t*, 3:1889
 general discussion 3:1886
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 nickel–chromium (Ni–Cr) alloys
 corrosion resistance 3:1885, 3:1886*f*
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 nickel–copper (Ni–Cu) alloys
 corrosion resistance 3:1883
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 nickel–molybdenum (Ni–Mo) alloys
 corrosion resistance 3:1884, 3:1885*f*
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 time–temperature–notch impact energy diagram
 3:1885*f*
 principal alloys 3:1881, 3:1881*t*
 steel
 anode and cathode separation 3:1708, 3:1708*f*
 flow rate effects 3:1708
 mass transport processes 3:1708
 welded-state corrosion behavior
 heat-affected zone (HAZ) 3:1894–1895, 3:1898, 3:1898*f*
 intercrystalline corrosion (IC) 3:1894–1895, 3:1900
 pitting resistance 3:1900
 surface conditions and treatment 3:1899

- corrosive environments (*continued*)
- carburation 1:401
 - cast iron
 - atmospheric corrosion 3:1750, 3:1751*t*, 3:1752*f*, 3:1752*t*
 - flow-induced corrosion
 - cavitation 3:1777, 3:1777*t*
 - erosion corrosion 3:1778, 3:1779*f*, 3:1780*f*, 3:1780*t*
 - gaseous environments
 - chlorine gas 3:1784, 3:1784*t*
 - gaseous mixtures 3:1785*t*, 3:1786*t*
 - gas transport and distribution pipes 3:1784
 - high-temperature oxidation 3:1780, 3:1781*f*, 3:1782*f*, 3:1783*f*, 3:1784*f*
 - hydrogen sulfide (H₂S) 3:1783, 3:1784*t*
 - sulfur dioxide (SO₂) 3:1783
 - industrial environments
 - alcohol corrosion 3:1772, 3:1773*t*
 - alkali corrosion 3:1767, 3:1767*f*, 3:1768*f*, 3:1768*t*
 - corrosion fatigue 3:1768, 3:1769*t*, 3:1770*f*, 3:1770*t*, 3:1771*f*, 3:1772*f*
 - food product corrosion 3:1773, 3:1773*t*
 - general discussion 3:1763
 - glycol corrosion 3:1772, 3:1773*t*
 - hydrochloric acid (HCl) corrosion 3:1765, 3:1765*f*, 3:1765*t*
 - mineral acid corrosion 3:1766
 - nitric acid (HNO₃) corrosion 3:1765, 3:1766*f*
 - organic acid corrosion 3:1766, 3:1767*t*
 - organic compound corrosion 3:1772
 - phosphoric acid (H₃PO₄) corrosion 3:1765, 3:1766*f*, 3:1767*t*
 - salt solutions 3:1768, 3:1768*t*, 3:1769*t*
 - stress corrosion cracking (SCC) 3:1770, 3:1772*f*
 - sulfuric acid (H₂SO₄) corrosion 3:1761*f*, 3:1762*f*, 3:1763, 3:1764*f*
 - microbially-induced corrosion (MIC)
 - action mechanisms 3:1775
 - gelatinous vesicle development 3:1775, 3:1776*f*
 - general discussion 3:1774
 - iron-oxidizing bacteria 3:1775
 - prevention strategies 3:1776
 - sulfate-reducing bacteria (SRB) 3:1775
 - molten materials
 - liquid aluminum/aluminum alloys 3:1773
 - liquid metals 3:1774
 - liquid sulfur corrosion 3:1774, 3:1774*t*
 - liquid zinc/zinc alloy corrosion 3:1774
 - natural waters
 - corrosion rates 3:1754, 3:1756*f*, 3:1756*t*
 - dissolved oxygen effects 3:1753, 3:1755*f*
 - galvanic corrosion 3:1756, 3:1757*t*
 - general discussion 3:1752
 - inhibitors 3:1757
 - water aggressiveness and corrosiveness 3:1752, 3:1754*f*, 3:1754*t*
 - protective measures 3:1762
 - seawater 2:1125, 2:1125*t*
 - corrosion rates 3:1759*t*, 3:1760*f*, 3:1760*t*, 3:1761*f*, 3:1762*t*, 3:1761*f*
 - general discussion 3:1758
 - gray cast iron corrosion rates 3:1759*t*
 - sodium chloride (NaCl) concentration effects 3:1758*f*
 - soil corrosion 3:1760, 3:1762*t*
 - steam corrosion 3:1757
 - urban/rural/marine atmospheres 3:1751*t*
- characteristics 1:399
- copper/copper alloys
 - atmospheric corrosion 3:1946, 3:1947*t*
 - contaminated environments 3:1960
 - freshwater environments 3:1954
 - general discussion 3:1946
 - high-temperature oxidation 3:1965
 - industrial chemicals 3:1962
 - natural water corrosion 3:1950
 - polluted conditions 3:1963, 3:1964*t*, 3:1965*f*
 - seawater 3:1958
 - soil corrosion 3:1949, 3:1949*t*
 - halide-containing environments 1:402
 - high-temperature corrosion 1:399
 - iron-nickel (Fe-Ni) alloys
 - atmospheric corrosion 3:1790, 3:1791*f*, 3:1791*t*
 - freshwater environments 3:1791
 - industrial environments
 - acid corrosion 3:1792, 3:1792*t*
 - galvanic corrosion 3:1793, 3:1794*t*
 - salt solutions 3:1792
 - stress corrosion cracking (SCC) 3:1793, 3:1793*t*
 - salt solutions 3:1792
 - seawater corrosion 3:1791, 3:1791*t*, 3:1792*t*
 - lead (Pb) 3:2060
 - maraging steels 3:1795, 3:1797*f*
 - metal chloride vapor pressure-temperature plot 1:403*f*
 - metallic coating protection 4:2521
 - molten metal environments 1:405, 3:1877
 - molten salt environments 1:405, 3:1876
 - natural environments 3:1795, 3:1797*f*
 - nitridation processes 1:400
 - oxidizing environments 1:400
 - petrochemical/chemical industries
 - industry characteristics 4:3208
 - process equipment
 - characteristics 4:3208, 4:3208*f*
 - coatings and linings 4:3212
 - electrochemical protection 4:3213
 - environmental cracking 4:3214*f*
 - environmentally-assisted cracking 4:3217, 4:3217*f*, 4:3218*f*, 4:3219*f*, 4:3220*f*, 4:3220*t*
 - external corrosion risks 4:3215, 4:3216*f*
 - failure incidents 4:3208-3209, 4:3209*f*
 - future trends 4:3226
 - general discussion 4:3227
 - inhibitors 4:3213
 - internal corrosion risks 4:3217, 4:3217*f*, 4:3218*f*, 4:3219*f*, 4:3220*f*, 4:3220*t*
 - materials selection 4:3210, 4:3210*f*, 4:3213
 - microprocess equipment 4:3226, 4:3226*f*
 - operating conditions 4:3208, 4:3208*f*
 - operation-based risk mitigation 4:3221, 4:3223*f*, 4:3224*f*
 - organic waste destruction 4:3225*f*
 - protective treatments 4:3212
 - risk-based cost benefit analysis 4:3223, 4:3225*f*
 - risk mitigation guidelines 4:3214
 - stress corrosion cracking (SCC) 4:3215*f*
 - supercritical water oxidation (SCWO) 4:3224-3226, 4:3225*f*
 - risk management 4:3207-3229
 - risk assessment guidelines 4:3011-3012
 - sulfur-containing environments
 - alumina-forming alloys 1:638
 - coal-fired boiler corrosion 1:404
 - general discussion 1:403
 - oil-fired boiler corrosion 1:404
 - zirconium (Zr)
 - aqueous environments
 - cooling waters 3:2112
 - salt solutions 3:2113, 3:2113*t*
 - sulfur compounds 3:2113
 - halogen acids
 - anodic polarization curves 3:2120*f*, 3:2121*f*
 - characteristics 3:2116
 - corrosion rates 3:2124*t*, 3:2128*t*
 - electrochemical protection 3:2129*t*
 - fluoride-containing solutions 3:2119*t*
 - hydrochloric acid (HCl) 3:2120*f*, 3:2121*f*
 - industrial environments 3:2130
 - isocorrosion diagram 3:2120*f*
 - inorganic acids
 - alkaline solutions 2:1204, 3:2124
 - chromic acid 3:2122
 - halogen acids 3:2116, 3:2130
 - hydrogen peroxide (H₂O₂) 3:2124
 - mixed acids 3:2122, 3:2124*t*
 - nitric acid (HNO₃) 3:2119, 3:2122*f*, 3:2124*t*, 3:2131
 - phosphoric acid (H₃PO₄) 3:2121, 3:2123*f*
 - sulfuric acid (H₂SO₄) 3:2113, 3:2115*f*, 3:2116*f*, 3:2117*f*, 3:2118*f*, 3:2124*t*
 - urea 3:2125

- organic acids
 - acetic acid 3:2125
 - chlorinated organic compounds 3:2126
 - formic acid 3:2125
- pressurized water and steam 3:2112
- corundum (α -Al₂O₃) 1:653, 1:654f, 1:674
- cosmic rays 2:1330
- counter electrodes 2:1372
- coupon testing
 - corrosion monitoring 4:3125, 4:3126f
 - statistical analysis
 - analysis of variance 2:1561r
 - extreme value (EV) analysis 2:1560, 2:1562f
 - general discussion 2:1559
 - linear polarization resistance measurements (LPRMs) 2:1562, 2:1563f
 - pit depth measurements 2:1560, 2:1561f, 2:1562f
 - response surface regression analysis 2:1562, 2:1563f
 - straight line regression models 2:1560, 2:1560f
 - weight loss 2:1560, 2:1560f
- cracking
 - anodic protection 4:2864
 - cement
 - alkali-silica reaction (ASR) 3:2362, 3:2362f
 - early age thermal cracking 3:2358
 - general discussion 3:2358
 - long-term drying shrinkage 3:2358, 3:2358f
 - plastic settlement cracking 3:2358, 3:2358f
 - plastic shrinkage cracking 3:2358
 - coating failures 4:2734
 - crack depth modeling
 - general discussion 2:1563
 - two-stage modeling 2:1563
 - crack mouth opening displacement (CMOD) 1:85, 1:86f
 - fracture mechanics 1:77-88
 - axially cracked pipes 1:83-84, 1:84f
 - elastic stress intensity factor (K_I) 1:81, 1:83f
 - fracture mechanics test specimens 1:84f
 - fracture toughness 1:85, 1:86f
 - \mathcal{J} -integral 1:84, 1:85f
 - \mathcal{J} R-curve 1:86, 1:86f
 - Mode I loading 1:81, 1:82f, 1:83f
 - stress corrosion cracking (SCC) 1:86, 1:87f, 1:88f
 - hydrogen cracking 2:923-927
 - characteristics 1:95r
 - general discussion 2:923
 - hydrogen embrittlement
 - basic concepts 2:925
 - pipeline welds 2:925f
 - testing methods 2:926, 2:927f
 - hydrogen-induced cracking (HIC)
 - basic concepts 2:924
 - magnesium alloys 3:2028
 - pipeline corrosion management 4:3294, 4:3295f
 - steel pipes 2:859, 2:859f, 2:925f
 - steel plates 2:924f
 - stress-oriented HIC 4:3295
 - testing methods 2:926
 - titanium/titanium alloys 3:2047
 - hydrogen sources 2:923, 2:924f
 - stress-oriented hydrogen-induced cracking (SOHIC)
 - failure mechanisms 2:925
 - general discussion 2:925
 - morphology 2:926f
 - testing methods 2:927
 - testing methods
 - hydrogen embrittlement 2:926, 2:927f
 - hydrogen-induced cracking (HIC) 2:926
 - stress-oriented hydrogen-induced cracking (SOHIC) 2:927
 - in-line inspection (ILI) techniques 4:3302
 - ultrasharp cracks 2:890, 2:891f, 2:892f, 2:893f
 - ultrasonic crack detection (USCD) 4:3302
 - see also environmentally-assisted cracking
- Crank-Nicolson scheme 1:313, 1:313f
- cratering 4:2735
- crawling 4:2734
- creosotes 2:1327, 3:2441
- crevice corrosion 2:753-771
 - airframe corrosion 4:3178r, 4:3179, 4:3180r
 - alkali corrosion 2:1194-1195, 2:1195f
 - aluminum alloys 2:1138, 3:1989
 - automotive bodywork 4:3169
 - basic concepts
 - comparisons to pitting corrosion 2:757
 - critical crevice solution (CCS) 2:755, 2:756f
 - general discussion 2:754
 - influencing factors
 - alloying processes 2:759
 - crevice geometry 2:758
 - critical crevice corrosion temperature (CCT) 2:759, 2:759r, 2:1128, 2:1129r
 - pitting resistance number (PREN) 2:759, 2:759r, 2:1128-1129, 2:1129r
 - solution chemistry 2:758
 - IR drop 2:756, 2:756f
 - metastable pits 2:757
 - schematic diagram 2:755f, 2:756f
 - brazed joints 3:2452
 - carbon steel 2:1194-1195, 2:1195f, 3:1711
 - characteristics 1:95r, 2:754
 - cobalt-based alloys 3:1928
 - copper/copper alloys 3:1952r
 - corrosion management 4:3010
 - corrosion-resistant alloys 2:1317
 - design-based mitigation 4:3075, 4:3077f
 - design guidelines 2:762
 - dissimilar metal crevices (DMC) 2:766
 - evaluation methods
 - field tests 2:760
 - general discussion 2:760
 - in-situ* tests 2:760
 - laboratory tests
 - ASTM standard F 2129-06 (cyclic potentiodynamic polarization measurements) 2:762
 - ASTM standard F 746-87 (metallic surgical implant materials) 2:761
 - ASTM standard G 48-03 (ferric chloride solutions) 2:760
 - ASTM standard G 78-01 (seawater solutions) 2:761
 - remote crevice assemblies 2:762
 - variable effects 2:760
 - industrial heating and cooling systems 4:2947
 - industry-specific applications
 - aircraft corrosion 2:767
 - metal-to-metal crevices 2:763, 2:763f
 - nonmetal-to-metal crevices 2:763
 - nuclear waste isolation 2:767
 - power plants
 - boiler and steam generators 2:766
 - boiling water reactors (BWRs) 2:766
 - heat exchangers and condensers 2:766
 - pressurized water reactors (PWRs) 2:766
 - surgical implants
 - dental fixtures 2:766
 - general discussion 2:763
 - nickel-free biomedical alloys 2:766
 - underground structures 2:768
 - marine environments 2:1116, 2:1118f, 2:1143
 - mechanical fasteners 3:2449
 - nickel-based alloys 2:1135-1136
 - nitric acid (HNO₃) solutions 2:1257
 - potable water systems 4:2947
 - stainless steels
 - characteristics 3:1829, 3:1830f
 - corrosion test methods 2:1486, 2:1488f, 2:1488r, 2:1489f
 - crevice initiation 2:1334-1335, 2:1335r, 2:1336f
 - highly corrosive environments 3:1822f
 - marine environments
 - crevice corrosion 2:1126f, 2:1127f
 - critical crevice corrosion solution values 2:1130r
 - critical crevice corrosion temperature (CCT) 2:759, 2:759r, 2:1128, 2:1129r
 - depth of localized attacks 2:1127r
 - exposure factors 3:1857r
 - general discussion 2:1125
 - maximum depth of crevice attack 2:1128r

- crevice corrosion (*continued*)
 pitting resistance number (PREN) 2:759, 2:759*t*, 2:1128–1129, 2:1129*t*
 304L 2:1126*f*, 2:1130*t*, 2:1131*t*
 316LVM 2:1127*f*, 2:1129*t*, 2:1130*t*, 2:1131*t*
 nitric acid (HNO₃) solutions 2:1257
 passive current density 2:1369*f*
 pitting corrosion 2:759, 2:759*t*, 2:795, 2:796*f*, 2:796*t*, 2:1334–1335, 2:1336*f*
 testing methods 2:1486, 2:1488*f*, 2:1488*t*, 2:1489*f*
 titanium/titanium alloys 2:1137, 3:2046
 wood 2:1324
 zirconium/zirconium alloys 3:2106
- crystoballite (SiO₂) 4:2942*t*
- critical pigment volume concentration (CPVC)
 basic concepts 4:2657
 component variations 4:2662*f*
 component volume–coarseness relationship plot 4:2662*f*
 film permeability 4:2662*f*
 film resistance 4:2662*f*
 paint properties 4:2662*t*
- crocodiling 4:2730
- crossfooting 4:2735
- crystal defects
 dislocations 1:104, 1:105*f*, 1:106*f*, 1:107*f*, 1:108*f*
 general discussion 1:102
 glide dislocation 1:107*f*
 grain boundaries and interfaces 1:108, 1:108*f*, 1:109*f*
 kinks and jogs 1:104, 1:106*f*, 1:107*f*
 point defects
 alumina (Al₂O₃) 1:129
 basic concepts 1:102
 chromium oxide (Cr₂O₃) 1:129
 cobalt oxide (CoO) 1:127
 general discussion 1:127
 interstitial sites 1:102–103
 intrinsic defects 1:103, 1:104*f*
 iron oxides 1:128
 nickel oxide (NiO) 1:113, 1:127
 schematic diagram 1:102*f*
 thermal defects 1:103
 surfaces 1:107, 1:107*f*
 terrace–ledge–kink (TLK) surfaces 1:107, 1:107*f*
- crystalline plastics
 fluorine-containing plastics 3:2383
 linear polyesters 3:2383
 polyamides (nylons) 3:2379*t*, 3:2383
 polycarbonates 3:2384
 polyethers 3:2383
 polyethylene 3:2383
 polyformaldehydes 3:2383
 polyolefins 3:2377, 3:2383
 polypropylene (PP) 3:2383
 polysulfones 3:2384
 polytetrafluoroethylene (PTFE) 3:2377, 3:2379*t*, 3:2383
- crystalline thermoplastics
 physical behavior 3:2374
 temperature–molecular weight phase diagram 3:2375*f*
- CSS Hunley (Civil War submarine) 4:3323, 4:3324*f*
- cubic boron nitride (CBN) 3:2301
- cubic law 1:136
- cubic stabilized zirconia (CSZ) 3:2294
- cultural heritage preservation 4:3307–3340
 challenges 4:3337*f*, 4:3338
 coatings
 coating types
 acrylic coatings 4:3328
 cellulose nitrate 4:3331
 general discussion 4:3328
 microcrystalline waxes 4:3330
 silanes 4:3331
 conservation-specific coatings 4:3324, 4:3325*f*
 patinas 4:3326, 4:3327*f*, 4:3328*f*
 surface preparation 4:3327, 4:3328*f*
 conservation efforts 4:3308
 conservation rationale 4:3309
 conservation standards 4:3309
- corrosion
 archaeological metals 2:1159, 4:3310, 4:3311*f*, 4:3312*f*
 conservation strategies 4:3310
 handling concerns 4:3313–3314, 4:3314*f*
 historical metals 4:3313, 4:3313*f*
 modern metals 4:3313–3314
 ethical practices 4:3310
 future developments 4:3337
 inhibitors
 benzotriazole (BTA) 4:3332, 4:3333*f*
 carboxylates 4:3334
 general discussion 4:3332
 tannins 4:3334, 4:3335*f*
 interventive treatments
 chloride removal 4:3318
 electrolytic techniques 4:3321, 4:3323*f*, 4:3324*f*
 hydrogen reduction 4:3323
 soluble ion removal techniques 4:3317
 stripping techniques 4:3320
 washing methods 4:3318, 4:3318*f*
 painted metals
 paint removal methods 4:3335
 refinishing methods 4:3335, 4:3336*f*
 preservation goals 4:3309
 preventive conservation
 deoxygenation 4:3317
 desiccation
 general discussion 4:3314
 practical humidity control 4:3315
 relative humidity threshold values 4:3314, 4:3315*f*, 4:3316*f*
- cuprite (Cu₂O) 4:2942*t*
- curing catalysts 4:2653
- current imaging tunnel spectroscopy (CITS) 1:379
- current-measuring instruments (ammeters) 4:2841, 4:2842*f*
- curtains 4:2741
- cutlery 3:1860, 3:1861*t*
- cutting fluids 2:1305
- cyclohexane 3:2380*t*
- cyclohexanol 3:2380*t*
- cyclohexylamine 4:2977, 4:2998*t*
- ## D
- data analysis
 corrosion behavior analysis 2:1680
 data-based modeling 2:1582
 interpolation techniques 2:1680
 neural network methods 2:1680–1692
 austenitic stainless steel pitting potential case study
 carbonate concentration effects 2:1689*f*
 chloride concentration effects 2:1688*f*
 general discussion 2:1687
 hydroxide concentration effects 2:1690*f*
 nitrate concentration effects 2:1689*f*
 sulfate concentration effects 2:1688*f*
 temperature effects 2:1690*f*
 basic concepts
 general discussion 2:1681–1682
 layered structure 2:1682*f*
 limitations 2:1682
 sigmoidal transfer function 2:1681*f*
 confidence fitting techniques 2:1684, 2:1685*f*
 general discussion 2:1690
 inconsistent data sets 2:1686
 industrial applications 2:1682
 training data requirements 2:1686
 variance estimations 2:1684, 2:1684*f*
 statistical analysis 2:1547–1580
 analytical methods
 Bayes' theory 2:1557
 experimental designs 2:1556
 extreme value (EV) distributions 2:1554
 general discussion 2:1550
 linear regression 2:1553
 Normal (Gaussian) distributions 2:1550
 Poisson process modeling 2:1553

- sampling theory/sample surveys 2:1556
 threshold techniques 2:1555
 Wiener process modeling 2:1555
- background information 2:1549
 corrosion studies
 corrosion engineering 2:1565
 corrosion monitoring 2:1577
 corrosion science 2:1559
 general discussion 2:1579
- Deacon reaction 1:478–479
 deactivators 2:1303*r*
 Dead Sea 2:1109*r*
 dealloying 2:801–809
 basic concepts 2:802
 copper/copper alloys 2:1135
 copper–gold (Cu–Au) alloys 2:805*f*
 future research areas 2:808
 gold (Au) corrosivity 3:2215
 historical background 2:802
 mechanisms
 brass dezincification 2:807, 2:807*f*
 critical potential (E_c)
 background information 2:804
 copper–gold (Cu–Au) alloys 2:805*f*
 current–voltage curves 2:805*f*
 silver–gold (Ag–Au) alloys 2:805*f*, 2:806*f*
 surface diffusion kinetics 2:806*f*
 industrial alloys 2:802
 ordered/disordered alloys 2:806
 potential dependence 2:804
 ternary element effects 2:807
 transport processes 2:804
 nanocrystalline alloys 2:802
 potential applications 2:802
 silver–gold (Ag–Au) alloys 2:803*f*, 2:805*f*, 2:806*f*
 stress corrosion cracking (SCC) 2:807, 2:871, 2:875*f*, 2:876*f*
- death-watch beetles 3:2445
 Debye–Hückel law 1:6, 2:1589, 2:1590*r*
 2-decylthio ethanamine (DTEA) 4:2968–2969
 deep-well installation 4:2819*f*, 4:2820
 defoamers 4:2653
 delamination 4:2730, 4:2735
 delayed ettringite formation 3:2365
 deliquescent relative humidity (DRH) 2:1060, 2:1061*r*
 demineralization processes 4:2973
 demulsifiers 4:2905*f*, 4:2903
 dental fixtures
 advanced technical ceramics 3:2303
 amalgams
 corrosion resistance 2:1316
 crevice corrosion 2:766
 health effects 2:1310
 bio-tribocorrosion 2:1045, 2:1046*r*
 corrosion-resistant alloys
 amalgams 2:1316
 health effects 2:1310, 2:1310*r*
 historical background 2:1308
 nickel titanium (NiTi) alloys 2:1314
 rare earth magnets 2:1310, 2:1316
 safety concerns 2:1308
 stainless steels 2:1314
 titanium/titanium alloys 3:2049
 crevice corrosion 2:766
 fluorine (F) 3:2045
 noble metals 3:2220, 3:2220*r*
- desalination
 corrosion monitoring 4:3143
 desalination plant 3:1865*f*
 general discussion 3:1863
 low-temperature multieffect plants (LT–MED) 3:1865
 multistage flash (MSF) process 3:1863
 reverse osmosis 3:1865
- Design Decision Model™ (DDM™) corrosion risk assessment 2:1163, 2:1163*f*
Desulfobacter spp. 4:2920
Desulfomaculum spp. 4:2949, 4:2920
Desulfomonas spp. 4:2949
Desulfovibrio spp. 2:1174, 2:1174*f*, 4:2949, 4:2920
- detergents
 lubricant systems 2:1303*r*
 vitreous enamel coatings 3:2335
 zinc coatings 4:2562
- detonation gun spraying (D-Gun) 4:2612*r*, 4:2616
 dezincification
 brass 3:1952
 characteristics 1:95*r*
 diamond (C) 3:2279*f*
 dibenzyl sulfide 4:2991
 dibenzyl sulfoxide 4:2991
 2-2-dibromo-3-nitrilopropionamide (DBNPA) 4:2968–2969
 dichloroethane 3:2380*r*
 dichloromethane 3:2380*r*
 dichloropropane 3:2380*r*
 dicyclohexylamine 4:2998*r*
 diethanolamine 4:2977
 diethylhydroxylamine 4:2976–2977, 4:2976*r*
 differential aeration cell corrosion 2:1324
 differential scanning calorimetry (DSC) 3:2393
 diffusion coatings 4:2532–2555
 aluminide coatings 1:701, 1:701*f*
 background information 4:2532
 basic characteristics 1:700
 fluidized bed techniques 4:2535*r*, 4:2540, 4:2540*f*, 4:2641
 gas and vapor phase chemical vapor deposition techniques 4:2535*r*, 4:2542, 4:2543*f*, 4:2544*f*, 4:2546*f*
 general discussion 4:2552
 inward growth diffusion coatings 4:2537, 4:2539*f*
 metallizing process 4:2535*r*, 4:2541
 modified aluminide coatings
 background information 4:2543
 bulk chemical analysis data 4:2548*r*
 chromium-modified aluminides 4:2548
 cyclic oxidation lifetimes 4:2549*f*
 cyclic oxidation performance 4:2551*f*
 fabrication processes 4:2544
 impurity effects 4:2546, 4:2548*r*
 platinum aluminide coatings 4:2544, 4:2545*f*, 4:2546*f*, 4:2547*f*, 4:2549*f*
 reactive element-modified aluminides 4:2549, 4:2550*f*
 silicon-modified aluminides 4:2548, 4:2549*f*
 yttrium-modified aluminides 4:2550*f*
 molten salt baths 4:2535*r*, 4:2541
 outward grown diffusion coatings 4:2538, 4:2539*f*
 pack cementation process
 aluminizing process 4:2534, 4:2537*f*, 4:2538*f*
 basic concepts 4:2534
 characteristics 4:2535*r*
 deposition temperatures 4:2536*r*
 facility diagram 4:2536*f*
 inward growth diffusion coatings 4:2537, 4:2539*f*
 outward grown diffusion coatings 4:2538, 4:2539*f*
 pack compositions 4:2536*r*, 4:2537*r*
 platinized coatings 1:702
 process routes 4:2535*r*
 SermaLoy J 4:2540*f*, 4:2548–2549, 4:2549*f*
 silicide diffusion coatings 1:702, 1:703*f*
 slurry cementation process 4:2535*r*, 4:2538, 4:2540*f*
 substrate alloy interdiffusion mitigation
 background information 4:2550
 metal–chromium–aluminum–yttrium (MCrAlY) coatings 4:2550
 SMARTCOAT concept 4:2551, 4:2552*f*, 4:2553*f*
- digital signals 2:1345
 dihydroxybenzene 4:2896*f*
 diisopropylamine 4:2998*r*
 dimension and conductivity scaling (DACS) method 2:840, 2:842*f*
 dimethyl ether (CH₃O₂) 2:1067*f*
 dimethyl formamide 3:2380*r*
 dimethylpentane 3:2380*r*
 dimethylpropane 3:2380*r*
 DIN 50 929 Part 3 soil assessment criteria 2:1162, 2:1162*r*
 dinitrobenzene 2:1326
 dioctyl-*p*-phenylenediamines (DOPPD) 3:2433
 direct chill casting 3:1984
 direct current voltage gradient (DCVG) surveys 4:2853, 4:2854*f*, 4:3285
 direct-indicating ammeter 4:2842*f*

- dislocations 1:104, 1:105*f*, 1:106*f*, 1:107*f*
disodium octaborate ($\text{Na}_2\text{B}_8\text{O}_{13}\cdot 4\text{H}_2\text{O}$) 2:1328
disodium octaborate tetrahydrate (DOT) 3:2441
dispersants 2:1104, 2:1303*t*, 4:2653
dissimilar metal crevices (DMC) 2:766
distillate lubricating oils 2:1300
dolomite 3:2013*t*
domestic products/kitchenware 3:1860, 3:1861*t*
Douglas fir 2:1325*t*
drinking water 3:1853
dry rot 3:2445
dryspray 4:2736
ductile cast iron 3:1740, 3:1740*f*, 3:1752*t*, 3:1769*t*
Ductile Iron Pipe Research Association (DIPRA) 2:1162
duplex stainless steels
 alkali corrosion 2:1199*f*, 2:1202*f*
 anhydrous hydrogen halide gases/hydrohalic acids 2:1212*f*
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*t*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 3:1858, 3:1858*t*
 cathodic modification 3:2237, 3:2238*t*, 3:2239*f*, 3:2241*t*
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1855*t*, 3:1863*t*, 3:1864*t*, 3:1874*t*
 commercial applications
 art and architecture 3:1858*f*, 3:1866, 3:1867*f*, 3:1866*f*
 domestic products/kitchenware 3:1860, 3:1861*t*
 process industry
 copper production 3:1862
 corrosion resistance 3:1863
 desalination 3:1863, 3:1865*f*
 hydrometallurgy 3:1861
 nickel production 3:1862
 oil and gas production 3:1867, 3:1869
 pulp and paper industry 3:1865
 wastewater treatment 3:1870
 zinc production 3:1862
 compositional ranges 3:1808*t*
 corrosion properties
 alloy composition influence 3:1825, 3:1826*f*
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830*f*
 crevice formers 3:1850*f*
 critical crevice corrosion temperature (CCT) 3:1850*f*
 critical pitting temperature (CPT)
 alloying element influences 3:1829*f*
 basic concepts 3:1827
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*
 photographic illustration 3:1829*f*
 potential dependence 3:1828*f*
 electrochemical reactions 3:1823, 3:1824*f*
 electrochemical testing methods 3:1846, 3:1847*f*
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845*f*
 general corrosion
 alkaline solutions 3:1843, 3:1844*f*
 characteristics 3:1838
 hydrochloric acid (HCl) 3:1840, 3:1840*f*
 nitric acid (HNO_3) 3:1842
 organic acids 3:1842, 3:1843*f*
 phosphoric acid (H_3PO_4) 3:1841, 3:1841*f*, 3:1842*f*
 sulfuric acid (H_2SO_4) 3:1838, 3:1839*f*, 3:1840*f*
 general discussion 3:1821
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*, 3:1850*f*
 grade screening methods 3:1849, 3:1850*f*
 intergranular corrosion 3:1845, 3:1845*f*
 laboratory tests 3:1850, 3:1851*t*
 localized corrosion 3:1824
 material selection tests 3:1849, 3:1851*t*
 passive films 3:1822, 3:1822*f*
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826*f*
 pitting potentials 3:1849*f*
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825*t*
 polarization curves 3:1824*f*
 postweld treatments 3:1837
 stress corrosion cracking (SCC)
 alkaline solutions 2:1200, 3:1833
 atmospheric environments 3:1834, 3:1835*f*
 characteristics 3:1830, 3:1831*f*
 chlorine-induced mechanisms 3:1832, 3:1832*f*
 film-induced cleavage 3:1831
 hydrogen embrittlement 3:1831
 hydrogen-induced stress cracking (HISC) 2:859, 2:859*f*, 3:1833
 laboratory tests 3:1850, 3:1851*t*
 material selection tests 3:1849, 3:1851*t*
 process mechanisms 3:1831
 slip dissolution 3:1831
 stress intensity factor–crack rate relationship 3:1832, 3:1832*f*
 sulfide stress cracking (SSC) 2:859, 2:859*f*, 2:860*f*, 3:1833
 welding-related corrosion 3:1837
 flow-induced corrosion 2:983*f*
 galvanic corrosion 2:849*f*, 2:853*t*, 2:855*f*
 high-temperature stainless steels
 chemical compositions 3:1874*t*
 corrosion resistance 3:1873
 halogen gas corrosion 3:1876
 molten metal environments 3:1877
 molten salt environments 3:1876
 oxidation behaviors 3:1875, 3:1875*f*
 sulfur attacks 3:1876
 hydrochloric acid (HCl) 2:1212*f*
 hydrogen sulfide (H_2S) environments 2:983*f*
 immersion tests/test compounds 3:1863, 3:1864*t*
 intergranular corrosion 2:818
 marine corrosion 2:1125
 mechanical properties
 cold work effects 3:1815, 3:1816*f*
 fatigue properties 3:1816, 3:1816*f*, 3:1817*t*
 general discussion 3:1812
 room temperature conditions 3:1812, 3:1813*t*
 stress–strain plots 3:1813*f*
 tempering temperature effects 3:1814*f*
 toughness impacts 3:1815, 3:1816*f*
 microstructure 3:1809*f*, 3:1811
 natural water environments
 chlorination effects 3:1852, 3:1852*f*
 drinking water 3:1853
 freshwater 3:1853, 3:1854*f*
 general discussion 3:1851
 microbially-induced corrosion (MIC) 3:1851, 3:1852*f*
 river waters 3:1853
 seawater
 anaerobic conditions 3:1857
 cathodic protection 3:1856
 exposure factors 3:1856, 3:1856*t*, 3:1857*t*
 hydrogen embrittlement 3:1856
 materials selection 3:1854, 3:1855*f*
 polluted environments 3:1855
 resistance factors 3:1854, 3:1855*t*
 physical properties 3:1819, 3:1820*t*
 precipitation/embrittlement
 carbide/nitride precipitation 3:1817
 carburization 3:1818
 475°C embrittlement 3:1817
 general discussion 3:1817
 heat treatments
 general discussion 3:1818
 precipitation hardening 3:1819
 quenching 3:1818
 solution annealing 3:1818, 3:1818*t*
 stabilization annealing 3:1819
 tempering 3:1819
 intermetallic phases 3:1817
 primary uses 3:1807, 3:1807*f*
 process equipment materials 4:3210–3211
 property relationships 3:1820
 Schaeffler–Delong diagram 3:1811*f*

stress corrosion cracking (SCC) 2:867*t*, 3:1836
 sulfuric acid (H₂SO₄) environments 2:1236*f*
 welding processes 3:2459
 dynamic mechanical analysis (DMA) 3:2393

E

early age thermal cracking 3:2358
 edge dislocation 1:104, 1:105*f*, 1:106*f*, 1:108*f*
 efflorescence 4:2736
 8xxx alloys 3:1982
 elastic stress intensity factor (K_I) 1:81, 1:83*f*
 elastomer blends 2:1205, 2:1224, 4:3210*f*
 electrical discharge machining (EDM) 3:2171
 electricity 2:1341–1373

basic concepts

admittance 2:1345
 capacitance 2:1344
 charge 2:1343
 conductivity/conductance 2:1344
 current 2:1343
 current density 2:1343
 impedance 2:1344
 inductance 2:1344
 potential 2:1343
 potential difference 2:1343
 resistivity/resistance 2:1343

instrumentation

amplifiers 2:1346
 current control 2:1351, 2:1351*f*, 2:1352
 current measurements 2:1348, 2:1351, 2:1351*f*
 filters 2:1346, 2:1346*f*
 potentiostat

basic circuit 2:1350, 2:1350*f*
 basic concepts 2:1349
 configurations 2:1351, 2:1351*f*
 current control 2:1351, 2:1351*f*
 current measurements 2:1351, 2:1351*f*
 limitations 2:1352
 negative feedback circuit 2:1350, 2:1350*f*
 operational amplifiers 2:1350, 2:1350*f*
 resistance measurements 2:1349, 2:1349*f*
 voltage measurements 2:1347

measurement fundamentals

amplifiers 2:1346
 characteristics 2:1345, 2:1345*r*
 filters 2:1346, 2:1346*f*
 time/frequency domains 2:1346

measurement methods

current

basic concepts 2:1348
 instrumentation 2:1348, 2:1351, 2:1351*f*
 impedance 2:1349, 2:1349*f*

resistance

basic concepts 2:1349
 instrumentation 2:1349, 2:1349*f*

voltage

basic concepts 2:1347
 differential measurements 2:1347
 instrumentation 2:1347
 interference effects 2:1348
 single-ended measurements 2:1347

see also electrochemistry

electrochemical depassivation 2:774

electrochemical impedance spectroscopy (EIS)

advanced measurement techniques 2:1360

basic concepts 2:1358

data analysis 2:1360

data presentation 2:1359, 2:1359*f*

passive film analysis 2:746

Randles equivalent circuit 2:1359*f*

electrochemical scanning tunnel microscopy (ECSTM)

background information 2:1433

electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*

general discussion 2:1441

implementation processes 2:1433, 2:1434*f*

limitations 2:1433

solid/liquid interface applications

active dissolution of metals 2:1434, 2:1435*f*

general discussion 2:1434

passive film growth and structure analysis 2:1436, 2:1437*f*

electrochemical stability diagrams

alloy stability diagrams 2:1596

basic concepts 2:1591

elevated temperature diagrams 2:1594

multiple active species effects 2:1594

nonideal solution diagrams 2:1595

potential–concentration diagrams 2:1597

potential–pH (Pourbaix) diagram 2:1591, 2:1593*f*

electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*

electrochemistry 1:13–51, 2:1341–1373

analytical methods

electrochemical impedance spectroscopy (EIS)

advanced measurement techniques 2:1360

basic concepts 2:1358

data analysis 2:1360

data presentation 2:1359, 2:1359*f*

passive film analysis 2:746

Randles equivalent circuit 2:1359*f*

electrochemical noise

aliasing 2:1367*f*

basic concepts 2:1363

corrosion monitoring 4:3131

data analysis 2:1363

instrumentation configurations 2:1365*f*

instrument noise 2:1366*f*

measurement methods 2:1364, 2:1366*f*

quantization noise 2:1367*f*

galvanic current 2:1353

harmonic analysis 2:1361

intermodulation distortion 2:1360*f*, 2:1361, 2:1362*f*

linear polarization resistance measurements (LPRMs)

basic concepts 2:1355

coupon testing 2:1562, 2:1563*f*

data analysis 2:1358

error analysis 2:1358

instrumentation configurations 2:1357*f*

noise levels 2:1357*f*

open circuit potential decay (OCPD) 2:1363, 2:1363*f*

polarization curves

background information 2:1353

data analysis 2:1354, 2:1355*f*

measurement methods 2:1354, 2:1354*f*

Tafel slope 2:1355, 2:1356*f*

potential monitoring 2:1353, 2:1353*r*

basic concepts

electrochemical reactions

corrosion processes 1:18, 1:18*f*

current flow mechanisms 1:16, 1:17*f*, 1:18*f*

discharge reactions 1:17*f*

galvanic (bimetallic) coupling 1:18, 1:18*f*

recharge reactions 1:18*f*

reduction reactions 1:17*f*

electronic and electrolytic materials and interfaces 1:15

metal–electrolyte interfaces

charge density distribution 1:21*f*

concentration profiles 1:22, 1:23*f*

electrical double layer 1:20, 1:21*f*

elementary/intermediate steps 1:19

intermediate species 1:19

mass transport mechanisms 1:21, 1:22*f*

potential profiles 1:22, 1:23*f*

schematic diagram 1:17*f*

cell design 2:1370

corrosion processes

electrochemical kinetics–corrosion potential 1:43, 1:44*f*, 1:45*f*, 2:726, 2:726*f*

Evans diagram 1:42*f*, 2:726*f*

exchange current density 1:42*f*

free corrosion conditions 1:41

mixed potential model 1:41, 1:42*f*

redox couples equilibrium potential curves 1:42*f*

uniform corrosion 2:726

- electrochemistry (*continued*)
- counter electrodes 2:1372
 - electrochemical cell
 - design guidelines
 - counter-electrode 1:46
 - electrode position 1:48, 1:48f
 - general discussion 1:45
 - potential–current distributions 1:48f
 - potential profiles 1:48f
 - reference electrode 1:46, 1:47f, 1:48t
 - working electrode 1:46
 - galvanostat diagram 1:50f
 - general discussion 1:45
 - potential control/current control 1:49, 1:49f, 1:50f
 - electrochemical equilibrium
 - definitions 1:24
 - exchange current density 1:24, 1:25f
 - Gibbs free energy 1:25
 - Nernst equation
 - ionic solutions 1:27
 - M²⁺/M couple 1:25, 1:26t
 - potential–pH (Pourbaix) diagram 1:28
 - redox couples equilibrium potential values 1:26t
 - normal hydrogen electrode (NHE) 1:25, 1:26f
 - potential–pH (Pourbaix) diagram
 - aluminum (Al) 1:31, 1:32f
 - general discussion 1:28
 - gold (Au) 1:30, 1:30f
 - iron (Fe) 1:30–31, 1:31f, 3:1702, 3:1703f, 3:1706f, 4:2894f
 - pH and potential-dependent equilibrium 1:29, 1:29f
 - purely pH-dependent equilibrium 1:29, 1:29f
 - purely potential-dependent equilibrium 1:28, 1:29f
 - sulfur (S) 3:1706f
 - electrode design 2:1366, 2:1368f
 - general discussion 1:14
 - modeling approaches 2:1582
 - out-of-equilibrium conditions
 - qualitative approach
 - current–overpotential curve 1:33f
 - current–potential curve 1:33f
 - general discussion 1:32
 - quantitative approach
 - Butler–Volmer equation 1:33, 1:35f
 - current–overpotential curve 1:35f, 1:36f, 1:40f
 - exchange current density 1:36f
 - Fick's law 1:38
 - general discussion 1:33
 - large overpotential limit 1:37, 1:38f
 - limited current density 1:38, 1:39f
 - mass-transport limited systems 1:38, 1:39f
 - mixed-control systems 1:39, 1:40f
 - small overpotential limit 1:36, 1:37f
 - passive current density 2:1369f
 - reference electrodes 2:1370, 2:1371t
 - see also* electricity
 - electrodeionization processes 4:2975
 - electrodeposition methods
 - aircraft corrosion 4:3188t
 - metallic coatings 4:2521
 - tin coatings 3:2074
 - electrodialysis 4:2975
 - electromagnetic acoustic transducer (EMAT) system 4:3153–3154
 - electron backscatter diffraction (EBSD) 2:880–881, 2:882f, 2:1411, 2:1413f
 - electron energy loss spectroscopy (EELS) 1:383, 1:385f, 2:1408, 2:1421, 2:1423f
 - electronic defects 1:112
 - electronic grade glasses 3:2307, 3:2308t, 3:2309t
 - electron microprobe analysis (EMA) 2:1376t
 - electron microscopy
 - electron energy loss spectroscopy (EELS) 1:383, 1:385f, 2:1408, 2:1421, 2:1423f
 - electron probe microanalysis (EPMA) 2:1420, 2:1422f
 - operational principles
 - basic concepts 2:1408
 - electron and X-ray generation 2:1408f, 2:1409f
 - incident electron beam–thin foil interactions 2:1408f
 - scanning electron microscopy (SEM)
 - backscattered electrons 2:1409–1410, 2:1410f, 2:1411f
 - basic concepts 2:1409
 - cementite analysis 1:286, 1:287f
 - characteristics 2:1376t
 - corrosion product characterizations 1:140, 1:142f
 - electron backscatter diffraction (EBSD) 2:880–881, 2:882f, 2:1411, 2:1413f
 - environmental scanning electron microscopy (ESEM) 2:1412
 - 'glaze' formation analyses 1:383
 - secondary electrons 2:1409–1410, 2:1410f
 - specimen preparation techniques 2:1415f, 2:1425
 - topographic images 2:1410–1411, 2:1412f
 - X-ray analyses 2:1419, 2:1419f
 - transmission electron microscopy (TEM)
 - basic concepts 2:1412
 - bright field (BF) images 2:1413–1414, 2:1414f
 - cementite analysis 1:286, 1:287f
 - convergent beam electron diffraction (CBED) 2:1417
 - corrosion product characterizations 1:140, 1:142f
 - dark field (DF) images 2:1413–1414, 2:1414f
 - electron beam damage effects 2:1415, 2:1415f
 - electron diffraction 2:1417, 2:1417f
 - 'glaze' formation analyses 1:379, 1:381f, 1:383
 - high angle annular dark field (HAADF) images
 - aluminum alloy cross-section 2:1414f
 - Nimonic alloys–Stellite 6 wear-affected surfaces study 1:382f, 1:383, 1:384f, 1:385f, 1:386f, 1:387f, 1:388f
 - high-resolution transmission electron microscopy (HRTEM) 2:1415, 2:1416f
 - nickel graphitization 1:294, 1:295f
 - scanning transmission electron microscopy (STEM)
 - characteristics 2:1416
 - Nimonic alloys–Stellite 6 wear-affected surfaces study 1:382f, 1:383, 1:384f, 1:385f, 1:386f, 1:387f, 1:388f
 - selected area diffraction (SAD) 2:1417
 - specimen preparation techniques 2:1415f, 2:1424, 2:1425f
 - TEM tomography 2:1416
 - X-ray analyses 2:1418–1419, 2:1419f, 2:1420f
 - X-ray analysis
 - basic concepts 2:1418
 - line scan profile 2:1420f
 - schematic diagram 2:1419f
 - spectral data plot 2:1419f, 2:1420f
 - electron probe microanalysis (EPMA) 2:1420, 2:1422f
 - electroplating *see* plated coatings
 - electrostatic spray deposition (ESD) 4:2611, 4:2640
 - elm 2:1325t
 - Elsener's equation 3:2214
 - emeraldine salts (ESs) 2:994
 - emulsifiable cleaners 4:2485
 - emulsion cleaners 4:2485, 4:2905f, 4:2903
 - enamel coatings *see* vitreous enamel coatings
 - energy dispersive spectrometry (EDS) 2:1418
 - energy dispersive X-ray (EDX) microscopy
 - aluminum alloy corrosion studies 2:1406, 2:1406f, 2:1419f, 2:1420f
 - corrosion product characterizations 1:140
 - Nimonic alloys–Stellite 6 wear-affected surfaces study 1:383, 1:384f, 1:385f, 1:386f, 1:387f, 1:388f, 1:389f, 1:392t
 - engineering design, procurement, and construction (EPC) 4:3067
 - enhanced radiolytic oxidation 3:2281
 - enthalpy
 - first law of thermodynamics 1:2
 - free enthalpy 1:5
 - latent heat of fusion 4:2932
 - entropy 1:4
 - environmentally-assisted cracking 2:857–863
 - aluminum alloys
 - corrosion fatigue 3:1995, 3:1996f
 - corrosivity 3:1993
 - hydrogen embrittlement 3:1996
 - liquid metal embrittlement (LME) 3:1995, 3:1995f
 - stress corrosion cracking (SCC) 3:1993, 3:1994f, 3:1995t
 - basic concepts 2:857, 2:858f
 - carbon steel 3:1712
 - corrosion management 4:3010
 - crack growth rates 2:858

- crack morphology
 appearance characteristics 2:858, 2:859f
 hydrogen-induced cracking (HIC) 2:859
 design-based mitigation 4:3074–3075
 environmental enhancement mechanisms 2:862
 fitness-for-service (FFS) assessments 4:3104f
 future research areas 2:863
 hydrogen cracking 2:923–927
 general discussion 2:923
 hydrogen embrittlement
 basic concepts 2:925
 pipeline welds 2:925f
 testing methods 2:926, 2:927f
 hydrogen-induced cracking (HIC)
 anhydrous hydrogen halide gases/hydrohalic acids 2:1210–1211
 basic concepts 2:924
 steel pipes 2:925f
 steel plates 2:924f
 testing methods 2:926
 hydrogen sources 2:923, 2:924f
 stress-oriented hydrogen-induced cracking (SOHIC)
 anhydrous hydrogen halide gases/hydrohalic acids 2:1210–1211
 failure mechanisms 2:925
 general discussion 2:925
 morphology 2:926f
 steels 2:1210–1211
 testing methods 2:927
 testing methods
 hydrogen embrittlement 2:926, 2:927f
 hydrogen-induced cracking (HIC) 2:926
 stress-oriented hydrogen-induced cracking (SOHIC) 2:927
 loading patterns 2:858f
 localized corrosion processes
 general discussion 3:2046
 hydrogen-induced cracking (HIC) 2:859, 3:2047
 stress corrosion cracking (SCC) 2:857, 2:859f, 2:860f, 3:2047
 magnesium alloys
 continuous crack propagation 3:2030f
 corrosivity 3:2028
 fracture surface appearance 3:2030f, 3:2031f
 friction stir weldment (FSW) 3:2031f
 open circuit potential (OCM) 3:2032f
 processing condition effects 3:2031f
 slow strain rate tensile (SSRT) tests 3:2029f, 3:2030f, 3:2031f
 stress corrosion cracking (SCC) 3:2030r, 3:2028
 stress-strain plots 3:2029f, 3:2031f, 3:2032f
 susceptibility 3:2030r
 transgranular cracking model 3:2030f
 petrochemical/chemical industries 4:3217, 4:3217f, 4:3218f, 4:3219f, 4:3220f, 4:3220r
 pure metal occurrences 2:863
 stress-strain effects
 crack velocity plot 2:861f
 fatigue crack growth curves 2:861f
 fatigue resistance 2:859, 2:860f
 testing methods 2:1527–1546
 bent specimens 2:1528f, 2:1531f, 2:1544–1545
 environmental conditions 2:1538, 2:1539f, 2:1540f
 static tests
 ‘C’ ring method 2:1545f
 delayed failure characteristics 2:1543f
 general discussion 2:1543
 gripping methods 2:1543f
 load-ring method 2:1544f
 spring-loaded test rig 2:1544f
 stress-corrosion tests
 cold work effects 2:1529–1530, 2:1530f, 2:1530r
 constant-load tests 2:1528f, 2:1530, 2:1531f
 constant total-deflection tests 2:1528, 2:1528f, 2:1533f
 crack velocity plot 2:1534f
 current density 2:1540f
 dynamic bend tests 2:1542, 2:1542f
 hydrogen embrittlement tests 2:1541
 initiation factors 2:1541, 2:1541f
 load relaxation curves 2:1529, 2:1529f
 polarization curves 2:1540f
 slow strain-rate tests 2:1531, 2:1532f, 2:1533f, 2:1534f
 static tests 2:1543
 stressing systems 2:1527
 test cell types 2:1540
 testpieces
 comparison studies 2:1536
 crack velocity measurements 2:1537
 precracked samples 2:1534, 2:1535f
 stressing systems 2:1527
 stress intensity factor–crack rate relationship 2:1536f
 surface finish effects 2:1538
 threshold stress intensities 2:1536, 2:1536f
 testing procedures 2:861, 2:862f
 environmental scanning electron microscopy (ESEM) 2:1412
 epichlorohydrin rubber (ECO) 3:2412r, 3:2413f, 3:2436
 epoxies
 coal tar epoxy system 4:2668t, 4:2694t, 4:2705, 4:2706f
 epoxy-amine coatings
 aircraft corrosion 4:3184t, 4:3188, 4:3189f, 4:3194t
 ballast tanks 4:2694t
 buried and ground-contact structures 4:2705, 4:2706f
 cargo holds 4:2697t
 characteristics 4:2695t
 external decks 4:2698t
 field joint coatings 4:2711
 film thickness 4:2675, 4:2675t
 iron and steel 4:2668t
 topsides and superstructures 4:2699t
 epoxy resins 3:2342, 3:2342t, 3:2384
 paints and organic coatings
 oxygen diffusion 4:2668t
 polymers 4:2651
 water diffusion 4:2668t
 equilibrium phosphate treatment 4:2984, 4:2985f
 erosion
 anodic protection 4:2864
 carbon steel 3:1712
 ceramics
 advanced technical ceramics 3:2286
 blast wear (pipes) 1:684
 flowing melts (converter) 1:684
 refractory materials 1:681
 coating failures 4:2736
 cobalt/cobalt alloys 3:1929, 3:1930f
 concrete degradation 3:2366, 3:2366f
 corrosion management 4:3010
 corrosion test methods 2:1489, 2:1490f
 flow-induced corrosion
 cast iron 3:1778, 3:1779f, 3:1780f, 3:1780r
 copper pipes 2:978f
 general discussion 2:977
 pump impeller photograph 2:978f
 solid particle erosion 2:978
 industrial heating and cooling systems 4:2948
 lubricant systems 2:1305
 nitric acid (HNO₃) solutions 2:1258
 potable water systems 4:2948
 solid particle erosion 2:978
 stainless steels 2:1258, 3:1846
 tribocorrosion
 applications
 current noise standard deviation plot 2:1045f
 electrochemical current/potential noise 2:1045f
 flow cell schematic diagram 2:1044f
 general discussion 2:1044
 basic concepts 2:1029
 depassivation–repassivation kinetics 2:1016f, 2:1018t, 2:1040
 mechanical–electrochemical interactions 2:1030f, 2:1038, 2:1038f, 2:1041t
 wear–corrosion interactions 2:1037r
 zirconium/zirconium alloys 3:2110, 3:2111f
 erythorbate 4:2976–2977, 4:2976t
Escherichia coli 4:2951–2952
 esters 2:1326
 etch pits 2:775
 ethanol 1:98f, 3:1842, 3:2380r, 4:3217f
 ethoxyethane 3:2380r
 ethyl acetate 3:2380r

- ethyl acrylate 3:1909
 ethylcellulose 3:2379r
 ethylene chlorotrifluoroethylene (ECTFE) 2:1246
 ethylenediaminetetraacetic acid (EDTA) 3:2326, 4:2486, 4:2527f, 4:2981, 4:3321
 ethylene dichloride (EDC) 1:403, 3:1908, 4:3221–3223, 4:3224f
 ethylene–propylene–diene rubber (EPDM) 3:2411, 3:2412r, 3:2413f, 3:2416r
 ethylene–propylene rubber (EPM) 3:2379r, 3:2411–2413, 3:2413f, 3:2431
 ethylene tetrafluoroethylene (ETFE) 2:1246
 ettringite
 conventional sulfate attacks 3:2363
 delayed ettringite formation 3:2365
 see also tricalcium aluminate (C₃A)
Euophyrum spp. 3:2445
 European Federation of Corrosion (EFC) 4:3057
 European Gas Pipeline Incident Data Group (EGIG) 4:3273
 Evans diagram 2:726f
 exfoliation
 aircraft corrosion
 airframe corrosion 4:3177, 4:3178r, 4:3180r
 aluminum alloys 4:3180, 4:3181r
 aluminum alloys 2:1138, 3:1993
 concrete degradation 3:2366, 3:2366f
 graphite (C) 3:2279
 expert judgment 4:3087
 extended X-ray absorption fine structure (EXAFS) 2:1397–1398, 2:1398f
 external decks 4:2698, 4:2698r
 extreme pressure/antiwear additives 2:1302, 2:1303r
 extreme value (EV) distributions
 basic concepts 2:1554
 chloride concentration variations 2:1572f
 coupon testing 2:1560, 2:1562f
 pit depth measurements 2:1570, 2:1571f
 wall thickness measurements 2:1567, 2:1568r, 2:1569f
 Eyre and Lewis soil assessment system 2:1162
- F**
- fading 4:2736
 Faraday's law 1:16, 1:38, 2:846, 4:2765
 fasteners
 mechanical fasteners 3:2449, 3:2450f, 3:2452r
 wood corrosivity
 bimetallic corrosion 2:1325
 construction materials 2:1327
 contact corrosion 2:1324
 corrosion test methods 2:1326
 general discussion 2:1323
 modeling methods 2:1327
 nail sickness 2:1325, 3:2442–2443
 preservative treatments 2:1327, 3:2442–2443
 water cooling towers 2:1328
 water tanks 2:1328
 fatigue, corrosion 2:928–953
 airframe corrosion 4:3178, 4:3178r
 alloys
 aluminum alloys 2:947, 2:948f
 carbon steel 3:2457
 ferrous alloys 2:944
 stainless steels 2:946, 2:946r
 titanium alloys 2:948
 aluminum alloys 3:1995, 3:1996f
 basic concepts
 crack growth rate–crack size plot 2:931f
 crack growth stages 2:931f
 general discussion 2:930
 initiation sites 2:931f
 persistent slip bands 2:931f
 cast iron
 curve plots 3:1770f, 3:1771f
 fatigue resistance 3:1770r, 3:1771f, 3:1772f
 general discussion 3:1768
 limiting strengths 3:1769r
 characteristics 1:95r
 corrosion management 4:3010
 corrosion test methods 2:1491, 2:1492f
 general discussion 2:950
 historical background 2:929
 influencing factors
 damage regimes 2:937r
 electrochemical conditions 2:942, 2:943f
 intermetallic particles 2:941
 loading frequency 2:941, 2:942f
 microstructure 2:941
 solution conditions 2:942
 stress state 2:944, 2:944f
 surface conditions 2:942, 2:943f
 loading patterns 2:858f
 low-pressure steam turbine (LPST) modeling study 2:1674r
 magnesium alloys 3:2028
 mechanical fasteners 3:2449
 nitric acid (HNO₃) solutions 2:1258
 photographic illustration 4:3104f
 prevention strategies
 barrier coatings 2:949
 cathodic protection 2:950
 general discussion 2:949
 surface treatments 2:950
 regimes and mechanisms
 damage regimes 2:937r
 general discussion 2:932, 2:940
 long crack growth
 basic concepts 2:938
 corrosion fatigue models 2:940
 linear elastic fracture mechanics (LEFM) analysis 2:938, 2:939f, 2:940
 short crack growth
 development stages 2:932, 2:932f, 2:933f
 initiation stage 2:932, 2:937r
 linear elastic fracture mechanics (LEFM) analysis 2:935
 loading frequency 2:941, 2:942f
 passive film breakdown 2:933
 pit–crack transition 2:935, 2:936f, 2:937f, 2:937r
 pit formation 2:933
 pit growth rate 2:934, 2:935f, 2:937r
 pitting corrosion fatigue models 2:938, 2:938r
 short crack–long crack interface 2:935, 2:937f, 2:937r
 surface film breakdown 2:934
 transition stages 2:933f
 S–N (stress–number of cycles to failure) curves 2:930f
 stainless steels 2:1258, 3:1836
 surgical implants 2:1318
 fatty acids 3:1766, 4:2670
 FBE–polypropylene coatings
 application frame 4:2713f
 application methods 4:2715f
 basic concepts 4:2713
 coextruded sheet method 4:2714f
 coextruded spiral tape 4:2715f
 injection molding 4:2714f
 plastic extrusion welding 4:2714f
 FBE powder coatings
 alternating current (AC) corrosion 4:2836f
 field joint coatings 4:2712, 4:2713f
 line pipe coatings 4:2708f, 4:2709, 4:2812r, 4:3283, 4:3283r
 feedwater treatment
 all volatile treatment (oxidizing) (AVT(O)) 4:2978
 all volatile treatment (reducing) (AVT(R)) 4:2977
 dissolved oxygen control 4:2975, 4:2976r
 flow accelerated corrosion (FAC) 4:2977
 general discussion 4:2975
 oxygenated treatment (OT) 4:2979
 oxygen scavengers 4:2975, 4:2976r
 pH control 4:2977
 ferritic chromium steels
 alloying elements 1:494r
 anode gas effects 1:494, 1:496f, 1:497f
 anode-side interactions 1:510, 1:511f, 1:512f
 carbonaceous gas formation 1:497, 1:498f
 cathode-side interactions 1:507, 1:508f
 characteristics 1:492
 component thickness effects 1:502, 1:503f, 1:504f, 1:505f
 compositions 1:501r

- contact resistance 1:501*f*
 design guidelines 1:499
 dual atmosphere conditions 1:507
 metal–glass sealant interactions 1:512, 1:513*f*
 oxidation rates 1:500*f*
 oxide scale formation 1:495*f*, 1:496*f*, 1:501*f*, 1:506*f*
 temperature dependence effects 1:502*f*
 thermal expansion coefficients 1:145*f*
 vaporization protection methods 1:509, 1:510*f*, 1:511*f*
- ferritic stainless steels
 acid pickling 4:2993*t*
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*t*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 3:1858, 3:1858*t*
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1855*t*, 3:1863*t*, 3:1864*t*, 3:1874*t*
 chromia-forming alloys 1:424–425, 1:425*f*, 1:426*f*
 commercial applications
 art and architecture 3:1858*f*, 3:1866, 3:1867*f*, 3:1866*f*
 domestic products/kitchenware 3:1860, 3:1861*t*
 process industry
 copper production 3:1862
 corrosion resistance 3:1863
 desalination 3:1863, 3:1865*f*
 hydrometallurgy 3:1861
 nickel production 3:1862
 oil and gas production 3:1867, 3:1869
 pulp and paper industry 3:1865
 wastewater treatment 3:1870
 zinc production 3:1862
 compositional ranges 3:1808*t*
 corrosion properties
 alloy composition influence 3:1825, 3:1826*f*
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830*f*
 crevice formers 3:1850*f*
 critical crevice corrosion temperature (CCT) 3:1850*f*
 critical pitting temperature (CPT)
 alloying element influences 3:1829*f*
 basic concepts 3:1827
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*
 photographic illustration 3:1829*f*
 potential dependence 3:1828*f*
 electrochemical reactions 3:1823, 3:1824*f*
 electrochemical testing methods 3:1846, 3:1847*f*
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845*f*
 general corrosion
 alkaline solutions 3:1843, 3:1844*f*
 characteristics 3:1838
 hydrochloric acid (HCl) 3:1840, 3:1840*f*
 nitric acid (HNO₃) 3:1842
 organic acids 3:1842, 3:1843*f*
 phosphoric acid (H₃PO₄) 3:1841, 3:1841*f*, 3:1842*f*
 sulfuric acid (H₂SO₄) 3:1838, 3:1839*f*, 3:1840*f*
 general discussion 3:1821
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*, 3:1850*f*
 grade screening methods 3:1849, 3:1850*f*
 intergranular corrosion 3:1845, 3:1845*f*
 laboratory tests 3:1850
 localized corrosion 3:1824
 material selection tests 3:1849
 passive films 3:1822, 3:1822*f*
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826*f*
 pitting potentials 3:1849*f*
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825*t*
 polarization curves 3:1824*f*
 postweld treatments 3:1837
 stress corrosion cracking (SCC)
 alkaline solutions 2:1200, 3:1833
 atmospheric environments 3:1834, 3:1835*f*
 characteristics 3:1830, 3:1831*f*
 chlorine-induced mechanisms 3:1832, 3:1832*f*
 film-induced cleavage 3:1831
 hydrogen embrittlement 3:1831
 hydrogen-induced stress cracking (HISC) 2:859, 2:859*f*, 3:1833
 laboratory tests 3:1850
 material selection tests 3:1849
 process mechanisms 3:1831
 slip dissolution 3:1831
 stress intensity factor–crack rate relationship 3:1832, 3:1832*f*
 sulfide stress cracking (SSC) 2:859, 2:859*f*, 2:860*f*, 3:1833
 welding-related corrosion 3:1837
 electrochemical potentiokinetic reactivation (EPR) test 2:1486
 erosion resistance 2:985*f*
 flow-induced corrosion 2:982*f*, 2:983*f*
 galvanic corrosion 2:852*t*
 high temperature oxidation behavior 1:553, 1:554*f*
 high-temperature stainless steels
 chemical compositions 3:1874*t*
 corrosion resistance 3:1873
 halogen gas corrosion 3:1876
 molten metal environments 3:1877
 molten salt environments 3:1876
 oxidation behaviors 3:1875, 3:1875*f*
 sulfur attacks 3:1876
 hydrogen sulfide (H₂S) environments 2:983*f*
 immersion tests/test compounds 3:1863, 3:1864*t*
 intergranular corrosion 2:818
 marine corrosion 2:1125
 mechanical properties
 cold work effects 3:1815, 3:1816*f*
 fatigue properties 3:1816, 3:1816*f*, 3:1817*t*
 general discussion 3:1812
 room temperature conditions 3:1812, 3:1813*t*
 stress–strain plots 3:1813*f*
 tempering temperature effects 3:1814*f*
 toughness impacts 3:1815, 3:1816*f*
 microstructure 3:1811
 natural water environments
 chlorination effects 3:1852, 3:1852*f*
 drinking water 3:1853
 freshwater 3:1853, 3:1854*f*
 general discussion 3:1851
 microbially-induced corrosion (MIC) 3:1851, 3:1852*f*
 river waters 3:1853
 seawater
 anaerobic conditions 3:1857
 cathodic protection 3:1856
 exposure factors 3:1856, 3:1856*t*, 3:1857*t*
 hydrogen embrittlement 3:1856
 materials selection 3:1854, 3:1855*f*
 polluted environments 3:1855
 resistance factors 3:1854, 3:1855*t*
 nitric acid (HNO₃) 2:1253
 noble metal additions 3:2241*t*
 physical properties 3:1819, 3:1820*t*
 polarization curves 2:1354, 2:1355*f*
 precipitation/embrittlement
 carbide/nitride precipitation 3:1817
 carburation 3:1818
 475°C embrittlement 3:1817
 general discussion 3:1817
 heat treatments
 general discussion 3:1818
 precipitation hardening 3:1819
 quenching 3:1818
 solution annealing 3:1818, 3:1818*t*
 stabilization annealing 3:1819
 tempering 3:1819
 intermetallic phases 3:1817
 primary uses 3:1807
 process equipment materials 4:3210–3211
 property relationships 3:1820
 Schaeffler–Delong diagram 3:1811*f*
 steam and steam/hydrogen environments
 construction materials 1:432*t*
 general discussion 1:431

- ferritic stainless steels (*continued*)
 inner scale formation 1:443f
 long-term behavior 1:436, 1:437f, 1:438f, 1:439f
 oxidation rates 1:440f, 1:441f, 1:442f
 pressure effects 1:449, 1:450f
 scale morphology 1:447f, 1:448f, 1:449f, 1:450f
 spalling tendencies 1:439f
 steam oxidation mechanisms 1:433, 1:434f, 1:435f
 temperature dependence effects 1:440, 1:440f, 1:441f, 1:442f, 1:443f, 1:445f
 void and gap formation 1:435, 1:436f, 1:437f, 1:438f, 1:439f
 weight change comparisons 1:433f, 1:442f, 1:444f
 stress corrosion cracking (SCC) 3:1835
 thermal expansion coefficients 1:145f
 welding processes 3:2458, 3:2459f
- Ferrobacillus* spp. 4:2949
- fiberglass products 3:2000
- fiber reinforced plastics (FRPs) 3:2387–2406
 above-water fastener selection 2:847f
 accelerated ageing 3:2395
 ageing effects
 chemical processing industry
 Arrhenius relationship 3:2403
 ASTM standard for long-term chemical resistance 3:2403
 Barcol hardness changes 3:2403f
 environmental conditions 3:2401
 failures and defects 3:2402f
 mass change–concentrated acid plot 3:2403f
 scrubbing tower 3:2401f
 semiempirical corrosion approach 3:2404
 uniform corrosion 3:2402f
 marine industry 3:2404
 oil and gas industry 3:2398, 3:2398f, 3:2399f, 3:2400f, 3:2401f
 supersonic flight 3:2396
- ageing mechanisms
 chemical ageing 3:2393
 fire resistance 3:2394
 general discussion 3:2390
 hygrothermal effects 3:2391
 mechanical degradation 3:2394
 physical ageing 3:2391
 synergistic effects 3:2394
 thermooxidative degradation 3:2392
 time-dependent effects 3:2391
 ultraviolet (UV) ageing 3:2393
 weather degradation 3:2393
- alkali corrosion 2:1204
 below-water fastener selection 2:849f
 general discussion 3:2388, 3:2405
 process equipment materials 4:3210, 4:3210f
 strength comparisons 3:2388f
- fibers, glass 3:2307, 3:2308t, 3:2309t
- Fick's law
 amorphous alloys 3:2197–2198, 3:2198f
 basic concepts 1:116
 charge–transfer reactions 2:1602–1603
 diffusion-controlled internal nitridation 1:306
 fiber reinforced plastics (FRPs) 3:2391–2392
 grain boundary diffusion 1:137f, 1:138
 ionic diffusion 3:2360
 out-of-equilibrium conditions 1:38
- field-erected water tube industrial boiler 4:2973f
- field joint coatings
 FBE-polypropylene
 application frame 4:2713f
 application methods 4:2715f
 basic concepts 4:2713
 coextruded sheet method 4:2714f
 coextruded spiral tape 4:2715f
 injection molding 4:2714f
 plastic extrusion welding 4:2714f
 FBE powder coatings 4:2712, 4:2713f
 general discussion 4:2711
 liquid-applied field joint coatings 4:2711, 4:2712f
 pipeline corrosion management 4:3284
 radiation cross-linked heat shrink sleeves 4:2712
 set-up 4:2711f
- field signature method (FSM) 4:3131, 4:3132f, 4:3133f
- filiform corrosion 2:988–1004
 airframe corrosion 4:3178t, 4:3179
 aluminum alloys 2:996f, 2:999, 2:999f, 2:1000f, 3:1990
 aluminum surfaces 2:996f, 2:997
 background information 2:996
 characteristics 1:95t, 2:996
 coating failures 4:2737
 general discussion 2:988
 iron/steel surfaces 2:1000, 2:1001f, 2:1002f
 propagation mechanisms 2:997, 2:997f
 surface-active filiform corrosion 2:999, 2:999f, 2:1000f
- fine and specialty chemicals 3:1910
- finite difference modeling methods 2:1583, 2:1583f
- finite element methods (FEM) 2:1583
- fireclay bricks 3:2338, 3:2338t
- fire damage 3:2367
- fire-retardant treatment chemicals 2:1328
- freside corrosion 1:457–481
 air–fuel ratio 1:461, 1:461f, 1:461t, 1:462t, 1:463t
 background information 1:459
 combustion conditions 1:461, 1:461f, 1:461t
 deposit chemistry 1:461, 1:465f
 flue gas composition 1:460, 1:460t, 1:462t, 1:463t
 fuel chemistry 1:459, 1:459t, 1:460f
 gas-phase corrosion
 general discussion 1:464
 oxidizing environments
 alloys 1:466f
 general discussion 1:464
 parabolic rate constant plot 1:467f
 steel 1:466f, 1:468f
 temperature limits 1:466t
 reducing environments 1:465
 isocorrosion rate curves 1:468f
 kinetic boundaries 1:469f
 steel 1:468f
- molten salt environments
 alloy corrosion resistance 1:480, 1:480f
 basic concepts 1:468, 1:469f
 chlorine-related corrosion 1:477, 1:479f
 coal constituents 1:475f
 corrosion rates 1:473f
 corrosion zones 1:471f
 fused salts 1:479–480, 1:480f
 oxide basicity 1:477f
 oxide solubility 1:476f
 sulfate-induced corrosion 1:461f, 1:472, 1:473f, 1:474f, 1:477f, 1:478f
 vanadium attacks 1:470, 1:470f, 1:471f, 1:472f
 superheater deposit composition 1:461, 1:464t, 1:465f
- first law of thermodynamics 1:2
- fitness-for-service (FFS) assessments 4:3102–3116
 basic concepts 4:3103
 environmentally-assisted cracking 4:3104f
 failure assessment diagram (FAD) 4:3104f, 4:3105, 4:3113f
 FITNET assessment procedure
 causal factors
 crack morphology 4:3110
 general discussion 4:3110
 service environment 4:3110
 stress 4:3110
 crack characterization 4:3109, 4:3109f
 general discussion 4:3109
 material characteristics
 ageing effects 4:3112
 general discussion 4:3110
 initial microstructure 4:3111
 surface conditions 4:3110, 4:3111f
 welds 4:3111
 stress corrosion cracking (SCC) data assessment parameters 4:3112, 4:3112f
 structural integrity assessments 4:3113, 4:3113f
- flat plate component example
 basic concepts 4:3113, 4:3114f

- Part A
 failure assessment point plot 4:3115, 4:3115f
 K_r parameter calculation 4:3114
 L_r parameter calculation 4:3114
 Part B (II): safe life assessment 4:3115, 4:3115f
 Part B (I): membrane stress 4:3115, 4:3115f
- K_r parameter
 basic concepts 4:3107
 example calculation 4:3108
 limiting conditions 4:3108f
- L_r parameter
 basic concepts 4:3106
 example calculation 4:3107
 limiting conditions 4:3106f
- oil and gas industry corrosion management 4:3264
- Flade potential 2:1380–1382
- flaking 4:2730, 4:2737
- flame cleaning 4:2491
- flame spraying
 aluminum coatings 4:2613, 4:2780
 characteristics 4:2612, 4:2612r
 high-velocity suspension flame spraying (HVSFS) 4:2613
 reactive flame spraying (RFS) 4:2613
- Flavobacterium* spp. 4:2920
- flocculation 4:2737
- flooding 4:2737
- floor lining 3:2346
- Flory–Rehner equilibrium swelling equation 3:2428
- flotation 4:2738
- flow accelerated corrosion (FAC) 4:2977
- flow agents 4:2653
- flow-induced corrosion 2:954–987
 basic concepts 2:1019, 2:1021f
 carbon steel 3:1712
 cast iron 3:1777, 3:1777r
 corrosion controls
 cathodic protection 2:983
 critical flow parameters 2:981r
 environmental controls
 C14-Quat concentration effects 2:984f
 computational fluid dynamics 2:985
 corrosion inhibitors 2:980, 2:983f
 drag-reducing agents 2:981–982, 2:984f
 fluid mechanics and design 2:979, 2:980f, 2:981r
 liquid droplet impingement 2:985
 materials selection
 cavitation resistance 2:982f
 copper/copper alloys 2:981f, 2:982f
 general discussion 2:980
 hydrogen sulfide (H_2S) environments 2:983f
 stainless steels 2:982f
 predictive modeling 2:985
 solid particle erosion 2:984, 2:985f
- corrosion management 4:3010
- corrosion processes
 cavitation
 bubble impact 2:979, 2:979f
 cast iron 3:1777, 3:1777r
 general discussion 2:977
 pump impeller photograph 2:978f
 characteristics 2:960
 concentration gradients 2:961f
 current density–potential plot 2:961f
 erosion
 cast iron 3:1778, 3:1779f, 3:1780f, 3:1780r
 copper pipes 2:978f
 gas bubble impingement 2:979
 general discussion 2:977
 liquid droplet impingement 2:979
 pump impeller photograph 2:978f
 solid particle erosion 2:978
- investigative tools
 general discussion 2:970
 impingement jets 2:971f, 2:973, 2:974f, 2:975r, 2:976f, 2:977f
 maximum local flow intensities 2:973, 2:976f, 2:977f
 pipe and channel flow 2:970f, 2:973, 2:975r, 2:976f, 2:977f
 rotating cages 2:971f, 2:972, 2:975r, 2:976f, 2:977f
 rotating cylinder electrodes 2:970f, 2:972, 2:975r
 rotating disc electrodes 2:970f, 2:971, 2:972f, 2:975r
 schematic diagrams 2:970f
 wall shear stress determination equations 2:975r, 2:977f
- Nernst diffusion layer 2:960, 2:961f
- scale-covered surfaces
 C14-Quat concentration effects 2:969f, 2:984f
 concentration gradients 2:963f
 corrosion rates 2:964f
 cracking tendencies 2:965f
 diffusion-controlled current densities 2:967f, 2:968f
 flow-induced localized corrosion (FILC) 2:964f
 freak wave impacts 2:968, 2:968f, 2:969f, 2:977f, 2:984f
 hydrodynamic interactions 2:966f
 iron carbonate ($FeCO_3$) 2:965f
 iron carbonate ($FeCO_3$) failure 2:965f
 iron sulfide (FeS) 2:965f
 linear wavelet transforms 2:967f, 2:968f
 pore diffusion calculations 2:962, 2:963f
 post-scale destruction corrosion intensities 2:969
 scale destruction 2:964, 2:964f
 spalling tendencies 2:965f
 surface fracture energies 2:965f
 system forces comparisons 2:966r
 scale-free surfaces 2:960, 2:961f
- corrosion risk mitigation 4:3056
- flow dynamics
 boundary layer 2:957, 2:957f, 2:958f, 2:959f
- flow patterns
 fluid–wall interactions 2:961f
 general discussion 2:959
 horizontal liquid–gas pipe flow 2:959f
 vertical liquid–gas pipe flow 2:960f
 vertical liquid–liquid pipe flow 2:960f
- laminar flow 2:955, 2:956f
 mass transport relationships 2:962r
 turbulent flow 2:955, 2:956f
- general discussion 2:955
- pipeline corrosion management 4:3293
- flue gas scrubber environments 3:2045
- fluidized bed techniques 4:2535r, 4:2540, 4:2540f, 4:2641
- fluorine (F)
 aluminum fluoride (AlF_3) 3:1907, 4:2537r
 calcium fluoride (CaF_2) 3:2119r, 3:2301, 3:2321r, 3:2331r
 chlorofluorocarbons (CFCs) 2:1067f
 corrosion potential 2:1264f, 2:1265r
 corrosive environments 1:403
 ethylene chlorotrifluoroethylene (ECTFE) 2:1246
 ethylene tetrafluoroethylene (ETFE) 2:1246
 fluorinated ethylene propylene 2:1246
 fluorine-containing plastics 3:2383
 fluorocarbon membranes 3:2343, 3:2343r
 glass ceramics 3:2297
 glass linings and coatings 3:2326
 high-temperature stainless steels 3:1876
 hydrofluoric acid (HF) 2:1207–1225
 acid pickling 4:2992, 4:2993r
 alumina ceramics 3:2290, 3:2291r
 aluminum coatings 4:2564f
 characteristics 2:1207
 copper/copper alloys 2:1214f, 3:1963
 corrosive environments 1:403
 electrochemical models 2:1619f
 glasses 3:2313
 inhibitors 4:2990
 nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1896r, 3:1897r
 nickel/nickel alloys 2:1214f, 2:1219f
 nitric acid–hydrofluoric acid (HNO_3 –HF) test 2:1479r, 2:1480f, 2:1480r, 2:1482
 noble metal corrosion resistance 3:2216r
 noble metals 2:1223
 pH 2:1207–1208, 2:1208f
 production processes 3:1907
 scale inhibitors/dispersants 4:2994
 stainless steel corrosion 2:1212f, 2:1214f
 steel corrosion 2:1210, 2:1210f, 2:1212f

- fluorine (F) (*continued*)
 thermoplastic materials 2:1223
 vitreous silica 3:2315
 zirconium corrosivity 3:2116, 3:2119r
 intermetallic alloys 1:659
 magnesium fluoride (MgF₂) 3:2301
 niobium corrosion 3:2144, 3:2146
 perfluoroalkoxy (PFA) 2:1246
 polytetrafluoroethylene (PTFE)
 chemical attack resistance 3:2377
 crevice corrosion 3:2107
 crystalline plastics 3:2383
 fluorocarbon membranes 3:2343, 3:2343r
 hydrohalic acid corrosion 2:1223–1224
 limiting oxygen index 3:2385r
 process equipment materials 4:3212
 solubility parameters 3:2379r
 sulfuric acid (H₂SO₄) environments 2:1246
 polyvinylidene fluoride (PVDF) 2:1223–1224, 2:1246, 3:2343, 3:2343i, 3:2385r, 4:3212
 potassium hydrogen fluoride (KHF) 4:2537r
 seawater constituents 2:1109r
 sodium fluoride (NaF) 3:2119r, 4:2537r
 sodium hexafluorosilicate (Na₂SiF₆) 3:2331r
 tantalum corrosion 3:2144, 3:2146
 titanium/titanium alloys 3:2045
 vitreous silica 3:2315
 water chemistry 2:1098, 2:1098r
 zirconium corrosivity 3:2116, 3:2119r
 fluorocarbon rubber (FPM) 3:2412r
 fluoroelastomers (FKM) 2:1224, 3:2413f, 3:2416r, 3:2431
 food product-based corrosion 3:1773, 3:1773r
 formaldehyde 2:1326
 formate 3:2060r
 formic acid
 acidic vapor corrosion 2:1326
 aluminum alloys 3:1998–1999
 anodic protection 4:2882
 corrosion risk mitigation 4:3060f
 dry deposition rates 2:1073r
 Henry's law coefficients for common gases 2:1056, 2:1056r
 inhibitors 4:2990
 maraging steels 3:1795
 rain chemistry 2:1063f, 2:1064r
 solubility parameters 3:2380r
 stainless steels 3:1842, 3:1843f
 wood corrosivity 2:1324
 zirconium corrosivity 3:2125
 forsterite 3:2013r
 fouling
 corrosion fatigue prevention strategies 3:2457–2458
 oil and gas industry 4:2916f, 4:2916
 foul release coatings 4:2692, 4:2692r
 Fourier transform infrared (FTIR) spectroscopy 3:2393
 475°C embrittlement 3:1817
 fracture mechanics 1:77–88
 axially cracked pipes 1:83–84, 1:84f
 elastic stress intensity factor (*K_I*) 1:81, 1:83f
 fracture mechanics test specimens 1:84f
 fracture toughness 1:85, 1:86f
 \int -integral 1:84, 1:85f
 \int *R*-curve 1:86, 1:86f
 Mode I loading 1:81, 1:82f, 1:83f
 stress corrosion cracking (SCC) 1:86, 1:87f, 1:88f
 Fréchet (Type II) distribution model 2:1554
 free enthalpy 1:5
 free ground water 2:1156
 Frenkel disorders 1:111
 freshwater environments
 copper corrosion
 pipework systems 3:1954
 pitting corrosion 3:1954
 iron–nickel (Fe–Ni) alloys 3:1791
 stainless steel corrosion 3:1853, 3:1854f
 steel corrosion 3:1729, 3:1730r
 fretting corrosion
 aircraft corrosion
 airframe corrosion 4:3178, 4:3178r, 4:3180r
 titanium alloys 4:3183
 automotive bodywork 4:3169
 causal factors 2:1318
 characteristics 1:95r
 cobalt–chromium–molybdenum (CoCrMo) alloy 2:1314, 3:1928
 nitric acid (HNO₃) solutions 2:1258
 stainless steels 2:1012–1013, 2:1012f, 2:1258
 testing methods 2:1495
 tin alloys 3:2076
 titanium nitride (TiN) 2:1316
 titanium/titanium alloys 2:1313
 zirconium/zirconium alloys 3:2110
 Friedel's salt 3:2351
 Frigilene™ lacquer 4:3331
 frit 3:2319, 3:2330, 3:2331r
 front end engineering design (FEED) 4:3066, 4:3068f
 Front End Engineering Design (FEED)
 basic concepts 4:3243
 data availability
 corrosion rate predictions 4:3245f, 4:3246f
 corrosion risk analysis 4:3247, 4:3247f
 financial projections 4:3247f
 installation and operational considerations 4:3248, 4:3250f
 laboratory tests 4:3247
 Norsok model 4:3245, 4:3245f
 procurement considerations 4:3248
 quality assurance (QA) practices 4:3248
 risk matrices 4:3247, 4:3247f
 theoretical calculations 4:3244, 4:3245f, 4:3246f
 uncertainty factors 4:3244
 frost damage 3:2366, 3:2366f
 fruit juices 3:1773r
 Frumkin isotherm 1:28, 2:1604–1605
 fuel cells
 molten carbonate fuel cells (MCFCs) 1:328
 solid oxide fuel cells (SOFCs) 1:482–517
 fullerenes 3:2274, 3:2279f
 fungi
 acid corrosion 2:1181
 airframe corrosion 2:1181, 4:3177
 characteristics 2:1172
 industrial heating and cooling systems 4:2949, 4:2950
 wood degradation effects 3:2441, 3:2445
 furan resins 3:2341, 3:2342r, 3:2384
 furring 3:2443, 3:2444
 fused salts 1:479–480, 1:480f, 2:1495
see also molten salts
 fused silica 3:2307, 3:2308r, 3:2309r
 fusion welding 2:1448, 3:2452r, 3:2453f
- G**
- gaboon 2:1325r
Gallionella ferrugine 4:2949
Gallionella spp. 2:1177, 2:1178f, 2:1183, 4:2920
 gallium (Ga)
 gallium oxide (Ga₂O₃) 3:2197f
 pitting corrosion potential 2:782f
 galvanic corrosion 2:828–856
 aircraft corrosion
 airframe corrosion 4:3178r, 4:3179, 4:3180r
 titanium alloys 4:3183
 aluminum alloys 2:1138, 3:1988
 basic concepts 2:829
 beneficial effects 2:837
 biomedical devices 2:1319
 carbon/graphite 3:2278
 carbon steel 2:1011, 2:1013f, 3:1711, 3:1757r
 cast iron 3:1743, 3:1756, 3:1757r
 cobalt/cobalt alloys 3:1928
 copper/copper alloys 2:1134–1135
 corrosion management 4:3010
 corrosion test methods 2:1470

- credible corrosion risks 4:3056
 design-based mitigation 4:3078, 4:3079f, 4:3080f
 determination criteria 2:838
 electrochemical theory
 basic concepts 2:829
 conductivity effects 2:837f
 coupled potential 2:833, 2:835f
 electrical/ionic resistance effects 2:834
 Evans diagram
 anodic–cathodic reactions 2:832–833, 2:833f
 coupled materials 2:834f
 coupled potential 2:835f
 forced potential shift–applied current diagram 2:833f
 polarization curves 2:834f
 galvanic series 2:831f
 IR drop 2:834, 2:836f
 iron corrosion 2:830f
 polarization curves
 anodic–cathodic reactions 2:832, 2:836f
 area ratio effects 2:834f
 coupled potential 2:832f
 passive films 2:835f
 polarization resistance effects 2:832f
 illustrative examples
 anodic plate–cathodic screws 2:838f
 carbon steel weld 2:839f
 copper pipe–stainless steel cylinder 2:838f
 mixed-metal corrosion 2:836, 2:837f
 industrial heating and cooling systems 4:2946
 iron–nickel (Fe–Ni) alloys 3:1793, 3:1794t
 lead (Pb) 3:2060
 magnesium alloys 3:2028, 3:2037
 marine environments 2:1118, 2:1119f, 2:1120f, 2:1143, 3:1756, 3:1757t
 mechanical fasteners 3:2449
 metal–matrix composites
 anodic/cathodic polarization diagram 3:2254f, 3:2255f, 3:2256f
 cathodic constituent content 3:2260, 3:2261f
 cathodic current densities 3:2260, 3:2260t
 environmental conditions 3:2254, 3:2255f
 general discussion 3:2253
 localized corrosion 3:2259, 3:2259f, 3:2261f, 3:2262f
 matrix metal corrosion 3:2254, 3:2255f
 microstructure 3:2259, 3:2259f
 n-type semiconductors 3:2256, 3:2256f
 p-type semiconductors 3:2256, 3:2256f
 reinforcement area fraction 3:2258, 3:2258f, 3:2259f
 reinforcement electrochemistry 3:2255, 3:2256f
 reinforcement photoelectrochemistry 3:2256
 reinforcement resistivity 3:2257, 3:2257t, 3:2258f
 molybdenum (Mo) 3:2163
 niobium and tantalum corrosion 3:2146
 nitric acid (HNO₃) solutions 2:1259
 potable water systems 4:2946
 prediction methods
 computer modeling 2:839, 2:841f
 exposure data 2:839
 general discussion 2:838
 laboratory data 2:839
 physical scale modeling 2:840, 2:842f
 potentiostatic data 2:839, 2:840f
 prior experience 2:839
 Wagner number 2:840, 2:842f
 prevention strategies
 anode–cathode reactions 2:843
 cathodic protection 2:844
 counter-current devices 2:844, 2:845f
 design changes 2:841, 2:843f
 electrical isolation 2:841–842, 2:843f
 environmental conditions 2:843
 general discussion 2:841
 inhibitors 2:844
 insulation changes 2:843
 stainless steels 2:831f, 2:851t, 2:852t, 2:853t, 2:854t, 2:1119f, 2:1259
 basic concepts 3:1844
 corrosion potential 3:1845f
 corrosion rates 3:1757t
 environmental conditions 2:1011, 2:1012f
 oil and gas industry 3:1868
 standards 2:850
 testing procedures
 accelerated testing 2:847
 atmospheric testing 2:846f, 2:847
 basic concepts 2:844
 corrosion rate determination 2:846
 galvanic series constructions 2:844
 hardware testing 2:844
 IR drop determination 2:845
 polarization curve generation 2:845
 washer test 2:846f
 wire-on-bolt/CLIMAT test 2:846f, 2:847
 tin (Sn) 3:2074, 3:2074t
 titanium/titanium alloys 2:1137
 uranium (U) 3:2186
 useful data
 atmospheric corrosion
 above-water fastener selection 2:847f
 general discussion 2:850
 urban/rural/marine atmospheres 2:848f
 carbon dioxide (CO₂) environments 2:855f
 hydrogen sulfide (H₂S) environments 2:855f
 seawater corrosion
 below-water fastener selection 2:849f
 corrosion rates 2:851, 2:851t, 2:852t, 2:854t
 crevice corrosion depth 2:853t
 sulfidation corrosion 2:850f
 tube alloy corrosion rates 2:853t
 valve alloys 2:849f
 weight loss for iron (Fe) 2:850t
 zinc corrosion 3:2080–2081
 zirconium/zirconium alloys 3:2109, 3:2110t
 galvanic lesions 2:1311
 galvanized steel 2:1165, 2:1166f
 galvanizing methods
 hot dip galvanizing
 continuous zinc/zinc alloy coatings 4:2570
 degreasing methods 4:2567, 4:2567f
 design guidelines 4:2566
 duplex coatings 4:2572
 fluxing operations 4:2567, 4:2567f
 galvanizing process
 alloying additions 4:2569
 basic concepts 4:2568
 coating development 4:2568, 4:2570f
 coating structure 4:2568f, 4:2569f
 steel reactivity 4:2568, 4:2569f, 4:2570f
 general discussion 4:2566
 organic systems 4:2572
 pickling methods 4:2567, 4:2567f
 post-galvanizing treatments 4:2570
 gamma(γ)-radiation
 characteristics 2:1330
 stainless steel corrosion
 corrosion potential 2:1334, 2:1334t
 crevice initiation 2:1334–1335, 2:1335t, 2:1336f
 current flow effects 2:1336f
 garnet-based lasers 3:2024, 4:2623
 gas chromatography (GC) 3:2393
 gas metal arc (GMA) technique 3:2024
 gastric fluids 2:1312f
 gas tungsten arc (GTA) technique 3:2024
 gas turbines 1:518–540
 alloy selections 1:525t
 basic concepts 1:518, 1:519f
 current research areas 1:538
 general discussion 1:538
 hot corrosion
 attack rates 1:535, 1:536f
 coating performance 1:537f
 damage locations 1:535, 1:535f
 deposit formation 1:532, 1:533f
 deposition flux–damage plot 1:537f
 fuel specifications 1:530t, 1:532
 general discussion 1:529

- gas turbines (*continued*)
 incubation times 1:538f
 modeling methods 1:535, 1:537f, 1:538f
 propagation mechanisms
 basic concepts 1:530
 characteristics 1:530f
 component phase diagram 1:531f
 oxide solubility 1:531f
 temperature distributions 1:535f
 hot gas path components and materials
 air cooling system schematic diagram 1:524f
 basic concepts 1:522
 coating compositions 1:523–524, 1:525r
 materials selection 1:525r
 material strength improvements 1:523f
 thermal barrier coatings 1:524f
 hot-salt corrosion 1:325
 noble metals 3:2220
 operating conditions
 basic concepts 1:520
 firing temperatures–pressure ratio plot 1:521f
 gas temperature cycles 1:522f
 temperature–pressure variations 1:521f
 oxidation processes
 basic concepts 1:524
 oxide scale growth 1:526f
 oxide scale growth and spallation models 1:526, 1:528f
 thermal barrier coatings
 characteristics 1:527f
 damage mechanisms 1:527
 operation principles 1:524f
 spallation models 1:528f, 1:529, 1:529f
 gear lubricants 2:1305
 general aerobic bacteria (GAB) 4:2920
 general corrosion *see* uniform corrosion
 generalized extreme value (GEV) distribution model 2:1554, 2:1562f
 generalized pareto distribution (GPD) 2:1555
 general linear regression models 2:1553
 general-purpose rubber goods (GRGs) 3:2411, 3:2412r
 germanium (Ge)
 germanium dioxide (GeO₂) 3:2197f
 metal dusting 1:288, 1:289f
Giardia lamblia 4:2951–2952
 Gibbs–Duhem equation 1:6
 Gibbs free energy
 amorphous alloys 3:2196, 3:2197f
 basic concepts 1:5
 chemical potential 1:8
 electrochemical equilibrium 1:25
 electrolyte systems 2:1589–1591
 single-oxidant thermodynamic reactions 1:181–182, 1:182r, 1:183f
 glass ceramics 3:2297, 3:2298f
 glasses 3:2306–2318
 anhydrous hydrogen halide gases/hydrohalic acids 2:1224
 borosilicate glass 2:1224, 2:1248, 3:2307, 3:2308r, 3:2309r, 3:2324r, 3:2325r
 characteristics 3:2307
 chemical properties
 corrosion resistance 3:2311r
 degradation conditions 3:2310
 durability tests
 general discussion 3:2311
 grain tests 3:2311
 whole-article tests 3:2311, 3:2312f
 commercial glasses 3:2307
 corrosion mechanisms
 acid attacks 3:2313
 agent systems 3:2313
 alkali corrosion 3:2313
 cleaning processes 3:2313
 general discussion 3:2311
 glass fiber-reinforced materials 3:2314
 hydrofluoric acid (HF) 3:2313
 metal salts 3:2313
 phosphoric acid (H₃PO₄) 3:2313
 water attacks 3:2313
 foamed glass bricks 3:2339, 3:2340r
 glass–ceramic composites 3:2306–2318
 characteristics 3:2317
 corrosion resistance 3:2317, 3:2318r
 properties 3:2317r
 glass fiber-reinforced resins 2:1223–1224, 3:2343
 glass linings and coatings 3:2319–2329
 advantages/disadvantages 3:2319
 damage monitoring and analysis
in-situ sensing technology 3:2327
 repair techniques 3:2328
 research developments 3:2328
 glass enamel corrosion
 acid environments 3:2326
 alkaline environments 3:2326
 complex formation 3:2326
 fluoride formation 3:2326
 general discussion 3:2325
 mineral acids 3:2326
 organic acids 3:2326
 water environments 3:2325
 glass-lined steel equipment manufacturing processes
 certifications and standards 3:2322, 3:2322r, 3:2323r
 glass formulations 3:2319, 3:2321f, 3:2321r
 glass preparation 3:2321
 lining process 3:2323
 metal preparation 3:2322
 glass-on-steel properties
 chemical corrosive environments 3:2324r
 chemical properties 3:2324
 corrosion inhibition 3:2327
 durability 3:2324r
 glass enamel corrosion 3:2325
 in-service enamel behavior 3:2325
 mechanical properties 3:2323
 surface properties 3:2325
 temperature-dependent leaching 3:2327
 testing methods 3:2324, 3:2325r
 thermal properties 3:2323
 glass reinforced plastics 3:2388f, 3:2400f, 3:2401f
 mechanical properties
 characteristics 3:2309r, 3:2310
 elastic modulus 3:2310
 strength 3:2310
 thermal shock resistance 3:2310
 metallic glasses
 background information 3:2192–2193
 corrosion behavior 3:2199
 corrosion-resistant bulk metallic glasses 3:2200
 metallic glass coatings 4:2617
 zirconium (Zr)-based bulk metallic glasses 3:2199
 noble metals 3:2219
 performance characteristics 3:2289, 3:2296
 physical properties
 chemical compositions 3:2308r
 structural characteristics 3:2308
 surface composition 3:2309
 thermal expansion coefficients 3:2309
 sulfuric acid (H₂SO₄) environments 4:3058f
 vitreous silica
 applications 3:2316
 characteristics 3:2314
 chemical attack resistance
 alkaline solutions 3:2315
 basic oxides 3:2316
 boiling water/steam 3:2315
 fluorine corrosion 3:2315
 general discussion 3:2315
 hydrofluoric acid (HF) 3:2315
 metal reaction products 3:2316
 pH 3:2316f
 electrical characteristics 3:2315
 heat resistance 3:2315
 manufacturing processes 3:2314
 polymorphic structure 3:2314, 3:2315f
 thermal conductivity 3:2315
 thermal expansion coefficients 3:2314

glass fibers 3:2307, 3:2308*t*, 3:2309*t*
 glass wools 3:2307, 3:2308*t*, 3:2309*t*
 glassy carbon 3:2273, 3:2275*t*, 3:2276
 glide dislocation 1:107*f*
 glow discharge optical emission spectroscopy (GDOES)
 basic concepts 2:1398
 characteristics 2:1376*t*
 depth profile 2:1401*f*
 schematic diagram 2:1399*f*
 gluconate 4:2486
 glutaraldehyde 4:2968–2969
 glycerol 3:2380*t*
 glycolic acid 3:2130
 glycols 2:1285, 3:1772, 3:1773*t*
 Gnedenko's limit theory model 2:1554
 goethite (FeO(OH)) 4:3311
 gold (Au)
 aluminum alloys 2:867*t*
 anhydrous hydrogen halide gases/hydrohalic acids 2:1223
 anodic protection 4:2874*t*
 archaeological metals 4:3312–3313
 coating characteristics 4:2526, 4:2526*f*, 4:2527*f*
 copper–gold (Cu–Au) alloys 2:805*f*, 2:867*t*, 3:2215
 corrosion behavior
 anodic processes 3:2214
 dealloying 3:2215
 extraction processes 3:2214
 nanoporous materials 3:2215
 corrosion potential 2:1261
 corrosive environments 1:92
 crystal structure 1:55*t*
 electroplated coatings 4:2584, 4:2587
 exchange current density 3:2217*t*
 galvanic corrosion 2:851*t*
 gold oxide (Au₂O₃) 3:2197*f*
 high-temperature properties 3:2217
 intermetallic alloys 1:658–659
 potential–pH (Pourbaix) diagram 1:30, 1:30*f*, 3:2211*f*
 production background 3:2206
 properties 3:2206, 3:2207*t*
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2245
 redox couples equilibrium potential values 1:26*t*
 silver–gold (Ag–Au) alloys 2:803*f*, 2:805*f*, 2:806*f*, 2:867*t*, 3:2215
 supply/demand estimations 3:2207*t*
 thermodynamic behavior 3:2210, 3:2211*f*
 granite 3:2000, 3:2340, 3:2341*t*
 grapefruit juice 3:1773*t*
 graphite (C) 3:2271–2281
 above-water fastener selection 2:847*f*
 alkali corrosion 2:1205
 anhydrous hydrogen halide gases/hydrohalic acids 2:1224
 anodic protection 4:2874*t*
 atomic structure 3:2275*f*
 background information 3:2271
 below-water fastener selection 2:849*f*
 degradation conditions
 aqueous corrosion behavior 3:2276
 aqueous environments 3:2276
 galvanic corrosion 3:2278
 high-temperature environments 3:2279
 high-temperature oxidation 3:2278, 3:2279*f*
 protective treatments 3:2279
 galvanic corrosion 2:1119*f*, 3:2110*t*
 galvanic series 2:831*f*
 graphite–cementite interface 1:287, 1:289*f*
 graphitization
 characteristics 1:95*t*
 industrial-use carbon 3:2273*f*
 impressed current anodes 4:2788, 4:2789*t*, 4:2813
 industrial applications 3:2275
 industrial graphite 3:2272, 3:2275*t*, 3:2276, 3:2277*f*
 metal dusting 1:293, 1:294*f*, 1:295*f*, 1:296*f*
 metal–matrix composites 3:2251
 nuclear graphite
 enhanced radiolytic oxidation 3:2281
 radiation damage 3:2280

physical properties 3:2274, 3:2275*t*
 process equipment materials 4:3211*f*
 pyrolytic graphite 3:2273, 3:2275*t*
 resistivities 3:2257*t*
 standard reduction potential 3:2074*t*
 sulfuric acid (H₂SO₄) environments 2:1248, 4:3058*f*
 gravitational water 2:1156
 gravity die casting techniques 3:2021
 gray cast iron 3:1739, 3:1739*f*, 3:1741*f*, 3:1751*t*, 3:1756*t*, 3:1759*t*, 3:1769*t*, 3:1773*t*
 greases 2:1301, 2:1303
 Green Death solution 3:1888–1889, 3:1900
 green field sites 2:1153–1154
 green rot carburization 1:401
 greigite 2:1288
 gribble 3:2442, 3:2445–2445
 grinning/grinning through 4:2738
 grit blasting 4:2567, 4:2567*f*
 grit inclusions 4:2738
 grooving corrosion 3:2457, 4:2948
 groundbed resistance
 deep-well groundbeds 4:2819*f*, 4:2820
 rectifier voltage determinations 4:2820
 resistance calculations 4:2818
 ground-contact structures 4:2702
 ground granulated blast furnace slag (GGBS) 3:2354
 ground water 2:1156
 growths and attachments 4:2738
 guayules 3:2410
 Gumbel (Type I) distribution 2:1565
 Gumbel (Type I) distribution model 2:1554
 G-values 2:1332
 gypsum (CaSO₄·2H₂O) 4:2938, 4:2942*t*

H

hafnium (Hf)
 alloys
 alloying element influences 1:546, 1:546*f*, 1:547*f*
 alumina-forming alloys 1:546, 1:546*f*, 1:547*f*, 1:608*t*, 1:609*t*, 1:628, 1:630*f*
 chromia-forming alloys 1:608*t*, 1:609*t*
 heat-resisting alloys–carburization effects 1:284
 intermetallic alloys 1:655, 1:659, 1:665
 nickel-based superalloys 1:693*t*
 zirconium–hafnium (Zr–Hf) alloys 3:2097*t*, 3:2098
 hafnium oxide (HfO₂) 3:2197*f*
 nitric acid (HNO₃)
 containment materials 2:1255
 corrosion reactions 2:1252
 oxidation processes 1:224
 physical properties 3:2096*t*
 ultrahigh-temperature ceramics 1:680
 Hall–Héroult process 3:1975
 Hamaker constant 1:344
 hardwoods *see* wood
 Haring–Blum cell 4:2599, 4:2599*f*
 hazards assessments 4:3012, 4:3013*t*
 heart research 2:1310*t*
 heat-affected zone (HAZ)
 anhydrous hydrogen halide gases/hydrohalic acids 2:1210–1211
 microscopy-based analytical techniques
 aluminum alloys 2:1406*f*, 2:1410*f*
 electron backscatter diffraction (EBSD) 2:1413*f*
 general discussion 2:1406–1407
 scanning electron microscopy (SEM) 2:1410*f*
 nickel alloys 3:1898, 3:1898*f*
 heated spray application 4:2640
 heat of vaporization 4:2932
 heat shrinkable materials 4:3283, 4:3283*t*
 heavy oil 1:459, 1:459*t*, 1:460*f*, 1:460*t*, 1:464*t*, 1:465*f*
 helium (He) 2:1053*t*
 hematite (Fe₂O₃) 1:31, 1:128, 4:2487, 4:2938, 4:2942*t*
 hemicellulose 2:1323, 2:1325, 3:2442
 see also wood
 hemihydrate (CaSO₄·1/2H₂O) 4:2942*t*
 Henry's law 2:725–726, 2:1055, 2:1056*t*, 2:1273, 4:2937–2938

- heptonate 4:2486
 heterogeneous thermodynamic systems 1:2
Hevea brasiliensis 3:2410
 hexagonal boron nitride (HBN) 3:2301
 hexamethylenamine 4:2998*t*
 hexamethyleneimine 4:2998*t*
 hexane 3:2380*r*
 hexanol 3:2380*r*
 high alumina cement (HAC) 3:2353
 high chromium cast iron 3:1746, 3:1748*f*, 3:1764*f*
 high conductivity coppers 3:1942
 high-density fireclay 3:2339
 high-density polyethylene (HDPE) 4:2715–2716
 high-pressure plasma spraying (HPPS) 4:2615
 high-resolution transmission electron microscopy (HRTEM) 2:1415, 2:1416*f*
 high silicon cast iron 3:1746, 3:1747*t*, 3:1748*r*
 high-temperature coatings 1:691–724
 coating types
 diffusion coatings
 aluminide coatings 1:701, 1:701*f*
 basic characteristics 1:700
 platinized coatings 1:702
 silicidic diffusion coatings 1:702, 1:703*f*
 overlay coatings
 metal–chromium–aluminum–yttrium (MCrAlY) coatings 1:696, 1:696*t*, 1:697*f*, 1:705, 1:706*f*, 4:2550
 oxide overlay coatings 1:698, 1:698*f*
 titanium–aluminum (Ti–Al) alloys 1:697
 protective oxidation
 alumina (Al₂O₃) layers 1:705, 1:706*f*
 aluminum depletion 1:709
 cracking 1:706, 1:707*f*, 1:708*f*
 estimated effective fracture energies 1:709*t*
 finite-element modeling predictions 1:708, 1:708*f*
 metal–chromium–aluminum–yttrium (MCrAlY) coatings 1:705, 1:706*f*
 spalling tendencies 1:706, 1:707*f*, 1:708*f*, 1:709*t*
 SMART MCrAlY overlay coatings 1:699, 1:699*f*, 1:700*f*
 thermal barrier coatings
 aeroengine applications 1:704*f*
 characteristics 1:704
 chemical failures 1:719, 1:720*f*
 cross-section diagram 1:705*f*
 failure characteristics 1:713, 1:714*f*, 1:715*f*, 1:716*f*
 martensite formation 1:717
 mechanical instabilities 1:716*f*, 1:717
 oxidation-induced failure 1:712
 schematic cross-section diagram 1:705*f*
 strain energy 1:715
 subcritical crack growth 1:716, 1:721*f*
 surface roughness 1:718, 1:719*f*, 1:720, 1:720*f*, 1:721*f*
 time-to-failure data plot 1:713*f*
 topcoat cracking 1:716*f*, 1:721*f*
 transformation strains 1:716
 importance 1:692
 metal–chromium–aluminum–yttrium (MCrAlY) coatings
 aluminum depletion
 chemical failures 1:711, 1:711*f*
 diffusion cells 1:710, 1:710*f*
 finite-difference modeling predictions 1:711–712, 1:712*f*
 uniform depletion 1:709
 characteristics 1:696
 compositions 1:696*t*
 microstructure 1:697*f*
 protective oxidation
 alumina (Al₂O₃) layers 1:705, 1:706*f*
 cracking 1:706, 1:707*f*, 1:708*f*
 estimated effective fracture energies 1:709*t*
 finite-element modeling predictions 1:708, 1:708*f*
 spalling tendencies 1:706, 1:707*f*, 1:708*f*, 1:709*t*
 time-to-failure data plot 1:713*f*
 structure 1:697*f*
 nickel-based superalloys 1:692, 1:693*f*, 1:693*t*
 requirements
 coating composition 1:694
 depletion profiles 1:695*f*
 protective oxide layer 1:693
 solute supply 1:694
 high-temperature oxidation 1:132–152
 alloy design requirements 1:541–557
 carburization 1:551
 environment-based alloy selection 1:549
 free energies 1:542*f*
 general discussion 1:541, 1:555
 nitridation processes 1:549, 1:550*f*, 1:551*f*
 oxidation lifetime maximization 1:547, 1:548*f*
 protective oxidation 1:542, 1:542*f*, 1:543*f*
 rare earth element additions 1:546, 1:546*f*, 1:547*f*
 scale adhesion 1:546, 1:546*f*, 1:547*f*
 scale formation 1:543, 1:543*f*, 1:545*f*
 selective oxidation 1:543, 1:543*f*, 1:545*f*
 steady-state oxidation 1:546
 sulfidation corrosion 1:551–552, 1:552*f*, 1:554*f*
 thermal expansion coefficients 1:548*f*
 water vapor effects 1:553*t*, 1:554*f*
 alumina-forming alloys 1:606–645
 breakaway oxidation
 failed specimen 1:635*f*
 failure mechanisms 1:636
 lifetime extension strategies 1:637
 time to breakaway 1:634, 1:635*f*, 1:636*f*
 unusual failure mechanisms 1:636, 1:637*f*
 compositions 1:607, 1:608*t*, 1:609*t*
 creep rupture life 1:611*f*
 environmental conditions
 carburization 1:551, 1:639
 general discussion 1:637
 hot corrosion 1:638
 nitridation processes 1:549, 1:639
 sulfidation 1:638
 water vapor effects 1:553, 1:553*t*, 1:637, 1:638*f*
 functionality 1:609*t*
 general discussion 1:640
 hydrogen permeability 1:612*f*
 selective oxidation
 alloy grain size effects 1:615, 1:616*f*
 general discussion 1:612
 metal–aluminum (M–Al) alloys 1:612, 1:612*f*, 1:613*f*
 metal–chromium–aluminum (MCrAl) alloys 1:613, 1:614*f*, 1:615*f*
 platinum-group metals 1:616, 1:617*f*
 scale development 1:613*f*
 temperature–aluminum content relationship 1:612*f*, 1:613*f*
 spalled oxide mass 1:610*f*, 1:617*f*
 steady-state oxidation
 coefficients of thermal expansion (CTEs) 1:631, 1:631*f*, 1:632*f*
 comparison studies 1:634
 cycle frequency effects 1:632, 1:632*f*, 1:633*f*
 general discussion 1:621
 growth mechanisms 1:624, 1:625*f*, 1:626*f*
 internal oxidation 1:633, 1:634*f*
 interstitial elements 1:630
 parabolic rate constants 1:622*t*, 1:624*t*
 platinum-group metals 1:631
 reactive element additions 1:624, 1:625*f*, 1:626*f*, 1:628, 1:628*f*, 1:629*f*, 1:630*f*
 scale adhesion 1:627, 1:628*f*
 scale growth rate 1:546*f*, 1:547*f*, 1:621, 1:622*f*, 1:623*f*
 scale morphology 1:626, 1:627*f*
 specimen mass gain 1:623*f*
 substrate strength 1:631, 1:632*f*
 time to breakaway 1:628*f*, 1:629*f*, 1:630*f*, 1:632*f*
 steam and steam/hydrogen environments
 alumina scale formation 1:449, 1:450*f*, 1:451*f*, 1:452*f*
 borderline alumina-forming alloys 1:452, 1:452*f*, 1:453*f*
 metastable alumina 1:451
 total mass gain 1:607, 1:610*f*, 1:614*f*, 1:617*f*
 transient oxidation
 base metal oxide formation 1:617, 1:618*f*, 1:619*f*
 cubic alumina phases 1:618, 1:620*f*, 1:621*f*
 scale development 1:619*f*
 specimen mass gain 1:619*f*
 total mass gain 1:618*f*

- analytical methods
 corrosion analysis methodology 1:139, 1:141f
 corrosion product characterizations 1:140, 1:142f, 1:143f
 cyclic oxidation 1:141f
 predictive modeling 1:142
 surface preparation 1:139
 two-stage oxidation experiments 1:140, 1:142f, 1:143f
- background information 1:133
- beryllium (Be)
 beryllium (Be) intermetallics (beryllides)
 general discussion 3:2177
 temperature effects 3:2178f, 3:2179f
 dry carbon dioxide (CO₂) effects 3:2176f
 general discussion 3:2174
 moist carbon dioxide (CO₂) effects 3:2177f
 temperature effects 3:2175f
- carbon steel 3:1713
- carburization 1:272–303
 alloy carburization
 alumina-forming alloys 1:551, 1:639
 carbide precipitation zones 1:278f
 chromium carbide precipitation 1:276t, 1:277t
 diffusion paths 1:278f
 heat-resisting alloys 1:282
 internal carbides 1:277t
 kinetic mechanisms 1:277, 1:279f, 1:279r
 microstructure characteristics 1:280, 1:280f, 1:281f
 partitioning effects 1:278f
 permeability data 1:276t, 1:279r
 phase diagram 1:278f
 rate variations 1:280f
 reaction morphologies 1:276
 thermodynamic properties 1:276
- basic concepts 1:274
- carbonaceous gas formation
 background information 1:273
 gas-phase processes 1:274, 1:274t, 1:275f
 solid oxide fuel cells (SOFCs) 1:497, 1:498f
- dissolution thermodynamics 1:275r
- environmental conditions 1:401
- general discussion 1:301
- green rot 1:401
- heat-resisting alloys
 aluminum effects 1:284, 1:285f
 carbon effects 1:283
 carburization rate constants 1:283r
 environment-based alloy selection 1:551
 molybdenum effects 1:283
 niobium effects 1:284, 1:284f
 post-carburization appearance 1:282f
 protective treatments 1:284
 reaction morphologies 1:282
 silicon effects 1:283
- metal carbide properties 1:275t
- metal dusting
 adsorbed sulfur protection 1:300, 1:301f
 alumina-forming alloys 1:551, 1:639
 austenitic iron–nickel (Fe–Ni) alloys 1:296, 1:297
 background information 1:285
 carbon uptake kinetics 1:297f
 cementite decomposition 1:286–287, 1:287f, 1:288f
 cementite formation 1:285, 1:286f, 1:287f
 coating protection 1:300
 coke filaments 1:286, 1:287f
 coking rates 1:290f, 1:291f
 environmental conditions 1:402
 environment-based alloy selection 1:551
 ferritic chromium steels 1:291, 1:292f, 1:293f
 gas composition effects 1:288, 1:290f, 1:297
 general discussion 1:301
 graphite–cementite interface 1:287, 1:289f
 Hochman–Grabke model 1:286f
 iron–aluminum (Fe–Al) alloys 1:292
 iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
 low-alloy steel 1:290, 1:290f, 1:291f
 mass transport model 1:287f
 nickel alloys 1:293, 1:294f, 1:295f, 1:296f, 1:297
- nickel–copper (Ni–Cu) alloys 1:296, 1:296f
 non-cementite iron dusting conditions 1:288, 1:289f
 oxide scale protection 1:298, 1:299f, 1:300f
 oxide to carbon conversion thermodynamics 1:300f
 risk management strategies 4:3224–3226, 4:3225f
 solid oxide fuel cells (SOFCs) 1:497
 temperature effects 1:288, 1:290f, 1:297
- molybdenum carbide (Mo₂C) 3:2165
- stainless steels 3:1818
- cast iron corrosion
 aluminum additive effects 3:1783f, 3:1784f
 chromium additive effects 3:1782f
 general discussion 3:1780
 heating and cooling cycle plot 3:1781f
 oxidation behaviors 3:1782f
 silicon additive effects 3:1783f
 superficial oxidation 3:1781f
- chromia-forming alloys
 steam and steam/hydrogen environments
 chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421f
 chromia-forming iron- and nickel-based alloys 1:418, 1:420f
 commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422f, 1:423f
 minor alloying element addition effects 1:423, 1:424f, 1:425f, 1:426f
 surface morphologies 1:423f
 water vapor effects 1:553, 1:553r
- chromium alloys
 austenitic stainless steels 1:591, 1:591f, 1:592f, 1:592t, 1:593f
 calculated partial pressures 1:590r
 cobalt–chromium (CoCr) alloys 1:593, 1:594f
 comparison studies 1:594, 1:594f, 1:595t, 1:596f, 1:597f
 general discussion 1:589
 global rating parameter (KB₄) 1:594, 1:596f
 martensitic and ferritic stainless steels 1:589, 1:590r
 metal loss/metal penetration studies 1:595t, 1:596f, 1:597f
 nickel–chromium (Ni–Cr) alloys 1:592, 1:593r
 nickel–iron–chromium (Ni–Fe–Cr) alloys 1:593, 1:593f, 1:594f
 solid oxygen fuel cell (SOFC) interconnectors 1:590r
 time to breakaway 1:590r
 weight gain 1:590f
- copper/copper alloys 3:1965
- diffusion processes 1:137, 1:137f
- gaseous environments 3:1780
- grain boundary diffusion 1:137, 1:137f, 1:139f
- graphite (C) 3:2278, 3:2279f
- high-temperature stainless steels 3:1875, 3:1875f
- intrinsic oxide scale growth
 stress effects
 chromia (Cr₂O₃) scale growth 1:160f
 experimental observations 1:155, 1:156f
 mass change–time plot 1:156f
 modeling methods 1:160
 nickel oxide (NiO) 1:158f, 1:159r
 parabolic stages 1:156f
 Pilling–Bedworth ratio (PBR) 1:146r, 1:160, 1:160r
 stress curve growth–time plot 1:158f
 stress growth measurements 1:159r
 wave formation 1:156f
- kinetic mechanisms 1:135, 1:135f, 1:136f, 1:186
- maraging steels 3:1800, 3:1800f
- metals and alloys 1:180–194
 alloy reactions
 exclusive scale growth criteria 1:191, 1:191f
 general discussion 1:190
 internal oxidation 1:192
 internal oxidation–external scale formation transition 1:193
 thermodynamics 1:190
 alumina (Al₂O₃) scale growth 148
 chromia (Cr₂O₃) scale growth 148
 general discussion 1:180, 1:193
 high-temperature stainless steels 3:1875, 3:1875f
 minor element influences 1:146
 nitridation processes
 basic concepts 1:260
 corrosion mechanisms 1:262
 environment-based alloy selection 1:549, 1:550f, 1:551f
 predictive modeling 1:261f, 1:262

- high-temperature oxidation (*continued*)
 pressure effects 1:263f, 1:264f, 1:265f
 thermochemistry 1:262
 transition stages 1:265f
 parabolic rate constant plot 1:146f, 1:147f
 Pilling–Bedworth ratio (PBR) 1:146r
 pure metal reactions
 dual-oxidant thermodynamic reactions 1:184
 Ellingham diagram 1:183f
 general discussion 1:181
 metal oxide transport properties 1:187, 1:188f, 1:189f
 phase stability diagram 1:184, 1:184f, 1:185f
 scale formation kinetics 1:186
 single-oxidant thermodynamic reactions 1:181, 1:182t, 1:183f
 Wagner's theory of internal oxidation 1:188, 1:189f
 reactive element effects
 general discussion 1:146
 location detection 1:148
 oxide scale adherence 1:148
 oxide scale growth kinetics 1:147f, 1:148
 oxide scale growth mechanisms 1:148
 scale formation kinetics
 basic concepts 1:186
 linear rate law 1:187
 logarithmic rate law 1:187
 parabolic rate law 1:186, 1:187f
 spalling tendencies 1:144
 thermal expansion coefficients 1:145f
 nickel-based superalloys 1:692, 1:693f
 oxide scale growth 1:101–131
 alumina (Al₂O₃) scale growth 148
 analytical methods
 corrosion analysis methodology 1:139, 1:141f
 corrosion product characterizations 1:140, 1:142f, 1:143f
 cyclic oxidation 1:141f
 predictive modeling 1:142
 surface preparation 1:139
 two-stage oxidation experiments 1:140, 1:142f, 1:143f
 background information 1:102
 chromia (Cr₂O₃) scale growth 148, 1:413, 1:414f
 crystal defects
 dislocations 1:104, 1:105f, 1:106f, 1:107f, 1:108f
 general discussion 1:102
 glide dislocation 1:107f
 grain boundaries and interfaces 1:108, 1:108f, 1:109f
 kinks and jogs 1:104, 1:106f, 1:107f
 point defects 1:102, 1:102f, 1:127
 surfaces 1:107, 1:107f
 terrace–ledge–kink (TLK) surfaces 1:107, 1:107f
 diffusion laws
 binary systems 1:118
 chemical diffusion 1:122
 diffusion mechanisms 1:117
 Fick's law 1:116
 general discussion 1:116
 grain boundary diffusion 1:137, 1:137f, 1:139f
 interdiffusion 1:118
 intrinsic diffusion 1:118
 Kirkendall effect 1:118, 1:118f
 lattice diffusion 1:117
 multiphase systems 1:119
 nonstoichiometric oxides 1:122
 short-circuit diffusion 1:121, 1:121f, 1:122f, 1:137
 ternary systems 1:120
 diffusion processes
 alumina (Al₂O₃) 1:129
 basic concepts 1:123, 1:123f
 chromium oxide (Cr₂O₃) 1:129
 cobalt oxide (CoO) 1:127
 general discussion 1:127
 iron oxides 1:128
 microstructure effects 1:124, 1:125f, 1:126f
 nickel oxide (NiO) 1:124, 1:125f, 1:126f, 1:127
 gas turbines 1:526, 1:526f, 1:528f
 intrinsic oxide scale growth
 chromia (Cr₂O₃) scale growth 1:160f
 experimental observations 1:155, 1:156f
 mass change–time plot 1:156f
 modeling methods 1:160
 nickel oxide (NiO) 1:158f, 1:159r
 parabolic stages 1:156f
 Pilling–Bedworth ratio (PBR) 1:146r, 1:160, 1:160r
 stress curve growth–time plot 1:158f
 stress growth measurements 1:159r
 wave formation 1:156f
 mass transport processes 1:130
 metals and alloys 1:180–194
 alloy reactions 1:190
 dual-oxidant thermodynamic reactions 1:184
 Ellingham diagram 1:183f
 general discussion 1:180, 1:193
 metal oxide transport properties 1:187, 1:188f, 1:189f
 phase stability diagram 1:184, 1:184f, 1:185f
 pure metal reactions 1:181
 scale formation kinetics 1:186
 single-oxidant thermodynamic reactions 1:181, 1:182t, 1:183f
 Wagner's theory of internal oxidation 1:188, 1:189f
 minor element influences 1:146
 parabolic rate constant plot 1:146f, 1:147f
 Pilling–Bedworth ratio (PBR) 1:146r
 point defects
 alumina (Al₂O₃) 1:129
 basic concepts 1:102
 chromium oxide (Cr₂O₃) 1:129
 cobalt oxide (CoO) 1:127
 electronic defects 1:112
 extended defects 1:115
 Frenkel disorders 1:111
 general discussion 1:127
 impurity effects 1:115
 interstitial sites 1:102–103
 intrinsic defect equilibria 1:114
 intrinsic defects 1:103, 1:104f, 1:110f
 ionic crystals 1:110
 ionized point defects 1:112
 iron oxides 1:128
 Kröger–Vink notation 1:110, 1:111f, 1:111r
 nickel oxide (NiO) 1:113, 1:127
 nonstoichiometric oxides 1:113
 point defect equilibria 1:113
 schematic diagram 1:102f
 Schottky disorders 1:111
 thermal defects 1:103
 reactive element effects
 general discussion 1:146
 location detection 1:148
 oxide scale adherence 1:148
 oxide scale growth kinetics 1:147f, 1:148
 oxide scale growth mechanisms 1:148
 scale formation kinetics
 basic concepts 1:186
 linear rate law 1:187
 logarithmic rate law 1:187
 parabolic rate law 1:186, 1:187f
 spalling tendencies 1:144
 stress effects
 active oxidation conditions 1:162
 dissolution/precipitation conditions 1:162
 epitaxial stresses 1:161–162
 general discussion 1:176
 geometrically induced growth stresses 1:161, 1:161f
 integrity effects 1:164
 intrinsic growth 1:155
 oxide composition changes 1:162
 protective treatments 1:171
 thermally induced scale changes 1:162
 surface reaction kinetics 1:413, 1:414f
 thermal expansion coefficients 1:145f
 short-circuit diffusion 1:137, 1:137f
 steam and steam/hydrogen environments
 chromia (Cr₂O₃) scale growth 1:413, 1:414f
 oxidation rate–hydration enthalpy relationship 1:415f
 surface reaction kinetics 1:413, 1:414f

- stress effects 1:153–179
 breakaway mechanism 1:155
 integrity measurements
 critical strain value–oxide scale failure 1:164, 1:166*f*, 1:167*t*, 1:168*t*, 1:169*f*, 1:171*f*
 elastic moduli 1:170*t*
 fracture toughness values 1:170*t*
 modeling methods 1:167, 1:169*f*
 Poisson ratios 1:170*t*
 surface fracture energies 1:170*t*
 intrinsic oxide scale growth
 chromia (Cr₂O₃) scale growth 1:160*f*
 experimental observations 1:155, 1:156*f*
 mass change–time plot 1:156*f*
 modeling methods 1:160
 nickel oxide (NiO) 1:158*f*, 1:159*t*
 parabolic stages 1:156*f*
 Pilling–Bedworth ratio (PBR) 1:160, 1:160*t*
 stress curve growth–time plot 1:158*f*
 stress growth measurements 1:159*t*
 wave formation 1:156*f*
 oxide scale growth
 active oxidation conditions 1:162
 dissolution/precipitation conditions 1:162
 epitaxial stresses 1:161–162
 general discussion 1:176
 geometrically induced growth stresses 1:161, 1:161*f*
 integrity effects 1:164
 intrinsic growth 1:155
 oxide composition changes 1:162
 protective treatments 1:171
 thermally induced scale changes 1:162
 protective oxide scale measures
 chromium (Cr) concentrations 1:173, 1:174*f*, 1:175*f*, 1:176*f*
 crack/damage healing processes 1:171, 1:172*f*, 1:173*f*
 oxide nodule formation 1:176*f*
 subsurface zone depletion effects 1:173, 1:174*f*, 1:175*f*, 1:176*f*
 significance 1:153
 strain values 1:155
 thermally induced scale changes
 coefficients of thermal expansion (CTEs) 1:163*t*, 1:165*f*
 cooling stresses 1:164*f*
 experimental observations 1:162
 modeling methods 1:164, 1:164*f*, 1:165*f*
 spectroscopic comparison plots 1:163*f*
 thermodynamics 1:134
 tungsten (W) 3:2155
 zirconium (Zr) 3:2126
 high-temperature tribocorrosion 1:331–398
 advanced material wear
 environmental conditions
 non-oxygen atmospheres 1:373
 oxygen partial pressure effects 1:371, 1:372*f*
 relative humidity effects 1:373
 water vapor effects 1:373
 intermetallic alloys
 characteristics 1:359
 silicon nitride (SiN/Si₃N₄) 1:355*f*, 1:360*f*, 1:364*f*, 1:365*f*, 1:371, 1:372*f*
 titanium–aluminum (Ti–Al)–ceramic counterfaces 1:362, 1:365*f*
 titanium–aluminum (Ti–Al)–metallic counterfaces 1:360, 1:363*f*, 1:364*f*
 Nimonic alloys
 coefficient of friction 1:380*f*
 ‘glaze’ formation 1:379
 Incoloy 800HT counterfaces 1:366*f*, 1:367*f*
 load effects 1:366, 1:368*f*, 1:371
 Nimonic alloys–Stellite 6 wear-affected surfaces study 1:383
 processing route effects 1:371
 silicon nitride (SiN/Si₃N₄) counterface 1:371, 1:372*f*
 sliding wear comparisons 1:371
 Stellite 6 counterface 1:366
 wear effects 1:366*f*, 1:367*f*, 1:369*f*, 1:370*f*, 1:372*f*
 weight change comparisons 1:380*f*
 oxide dispersion strengthened (ODS) alloys
 characteristics 1:354
 Incoloy 800HT 1:355, 1:364
 Incoloy alloys 1:354
 Inconel alloys 1:354
 load effects 1:358, 1:361*f*, 1:362*f*
 Nimonic alloys 1:364
 Stellite 6 steel 1:357, 1:366, 1:379
 sliding surface pretreatment effects
 ion implantation 1:374, 1:375*t*, 1:376*t*
 preoxidation processes 1:374, 1:374*f*
 presliding effects 1:374, 1:374*f*
 background information 1:336
 general discussion 1:396
 ‘glaze’ formation
 compact oxide formation 1:344, 1:377, 1:378*f*
 general discussion 1:376
 microscale studies 1:376
 nanoscale studies
 coefficient of friction 1:380*f*
 general discussion 1:379
 Incoloy alloys 1:389, 1:391*f*
 Nimonic alloys–Stellite 6 wear-affected surfaces study 1:383
 wear effects 1:381
 weight change comparisons 1:380*f*
 Nimonic alloys–Stellite 6 wear-affected surfaces study
 relevant element oxidation tendencies 1:389*f*
 scanning electron microscopy (SEM) 1:381*f*, 1:383
 scanning transmission electron microscopy (STEM) 1:382*f*, 1:383, 1:384*f*, 1:385*f*, 1:386*f*, 1:387*f*, 1:388*f*
 spectral data 1:392*t*
 structural characteristics 1:387, 1:390*f*, 1:391*f*
 wear maps 1:393, 1:394*f*
 third body interactions 1:377
 wear maps
 abrasive wear 1:393*f*
 alternative parameter maps 1:393*f*
 characteristics 1:389
 dissimilar interfaces 1:393
 Incoloy alloys 1:394*f*, 1:395, 1:395*f*
 Lim model 1:392
 load–amplitude plot 1:341*f*
 Nimonic alloys–Stellite 6 wear-affected surfaces study 1:393, 1:394*f*
 oxide chemistry 1:396
 sliding conditions 1:392*f*
 wear theory
 early wear theory
 Archard–Hirst model 1:336, 1:339*f*, 1:345
 like-on-like sliding effects 1:339*f*
 mechanism classifications 1:338, 1:339*t*
 mild–severe wear distinctions 1:336, 1:337*f*
 wear rate variations 1:337*f*
 load–sliding speed effects
 carbide effects 1:353
 cobalt-based alloys 1:349
 research background 1:347
 Stellite 6 steel 1:351, 1:357, 1:366, 1:379
 wear rate effects 1:348*f*, 1:349*f*
 mild wear theory
 Archard–Hirst model 1:345
 compact oxide formation 1:344, 1:377, 1:378*f*
 discontinuous contact model 1:346
 Quinn’s oxidational wear model 1:345, 1:346*f*
 second phase effects 1:353
 ‘two and three body’ wear theory
 attractive forces effects 1:343
 background information 1:340
 load–amplitude plot 1:341*f*
 particle behavior at wear interface 1:342, 1:343*f*
 preoxidized films 1:341
 surface films 1:341
 high-velocity oxy–fuel (HVOF)/high-velocity air fuel (HVAF) spraying 4:2612*t*, 4:2615, 4:2626
 high-velocity suspension flame spraying (HVSFS) 4:2613
 high-volume low-pressure (HVLP) spraying techniques 4:2610, 4:2639
 highway infrastructure 4:3200*f*, 4:3201*f*, 4:3202*f*, 4:3203
 historical metals 4:3313, 4:3313*f*
 HMS *Holland* 4:3318, 4:3338
 HMS *Minerva* 4:3322, 4:3336, 4:3338
 Hochman–Grabke model 1:286*f*
 holidays 4:2739, 4:2850, 4:2851*f*

- homogeneous thermodynamic systems 1:2
 - Hooke's law 1:78
 - hopeite 4:2497*t*, 4:2498, 4:2501
 - Hormoconis resiniae* 2:1181
 - hot and cold rolling 3:1985
 - hot corrosion
 - gas turbines
 - attack rates 1:535, 1:536*f*
 - coating performance 1:537*f*
 - damage locations 1:535, 1:535*f*
 - deposit formation 1:532, 1:533*f*
 - deposition flux–damage plot 1:537*f*
 - fuel specifications 1:530*t*, 1:532
 - general discussion 1:529
 - incubation times 1:538*f*
 - modeling methods 1:535, 1:537*f*, 1:538*f*
 - propagation mechanisms
 - basic concepts 1:530
 - characteristics 1:530*f*
 - component phase diagram 1:531*f*
 - oxide solubility 1:531*f*
 - temperature distributions 1:535*f*
 - intermetallic alloys
 - alumina-forming alloys 1:638
 - chlorine-containing environments
 - gaseous environments 1:661
 - molten salts 1:662, 1:662*f*
 - general discussion 1:660
 - sulfur-containing environments
 - gaseous environments 1:660
 - molten salts 1:661, 1:661*f*
 - hot-dipped coatings 4:2556–2576
 - aluminum coatings 4:2564
 - applications 4:2572, 4:2573*t*
 - basic concepts 4:2556
 - dipping process
 - basic concepts 4:2565
 - operating principles
 - cleaning 4:2565
 - dipping 4:2566
 - post-treatment 4:2566
 - practicabilities 4:2521
 - duplex coatings 4:2572
 - future developments 4:2573
 - hot dip aluminization 4:2572
 - hot dip galvanizing
 - continuous zinc/zinc alloy coatings 4:2570
 - degreasing methods 4:2567, 4:2567*f*
 - design guidelines 4:2566
 - duplex coatings 4:2572
 - fluxing operations 4:2567, 4:2567*f*
 - galvanizing process
 - alloying additions 4:2569
 - basic concepts 4:2568
 - coating development 4:2568, 4:2570*f*
 - coating structure 4:2568*f*, 4:2569*f*
 - steel reactivity 4:2568, 4:2569*f*, 4:2570*f*
 - general discussion 4:2566
 - organic systems 4:2572
 - pickling methods 4:2567, 4:2567*f*
 - post-galvanizing treatments 4:2570
 - hot tinning 4:2571
 - metallic coatings 4:2521
 - organic systems 4:2572
 - standards
 - ASTM standards 4:2574*t*
 - EN/ISO standards 4:2573*t*
 - general discussion 4:2573
 - terne coatings 4:2565, 4:2571
 - tin coatings
 - basic concepts 4:2556
 - corrosion behavior 4:2564
 - general discussion 3:2074
 - hot tinning 4:2571
 - zinc coatings
 - alloying additions 4:2569
 - atmospheric corrosion 4:2558, 4:2559*t*, 4:2560*t*
 - continuous zinc/zinc alloy coatings 4:2570
 - corrosion behavior 4:2557, 4:2557*f*, 4:2558*f*
 - detergents 4:2562
 - inorganic chemicals 4:2562–2563
 - lubricants 4:2563
 - organic chemicals 4:2563
 - soil corrosion 4:2562, 4:2563*t*
 - steel 4:2563
 - water corrosion 4:2562, 4:2562*t*
 - white rust 4:2563–2564
 - zinc–aluminum (Zn–Al) alloy coatings 4:2557*f*, 4:2558, 4:2558*f*
 - zinc–iron (Zn–Fe) alloys 4:2558
- house longhorn 3:2445
- Huey test 2:1478
- Hull cell 4:2599, 4:2599*f*
- humic acids 2:1099
- humidity *see* relative humidity (RH)
- hureaulite 4:2497*t*
- Hutchinson, Rice, and Rosegren (HRR) field equation 1:84
- hydrazine 4:2976, 4:2976*t*
- hydrocarbon cracking processes 1:274
- hydrogen cracking 2:923–927
 - characteristics 1:95*t*
 - general discussion 2:923
 - hydrogen embrittlement
 - basic concepts 2:925
 - pipeline welds 2:925*f*
 - testing methods 2:926, 2:927*f*
 - hydrogen-induced cracking (HIC)
 - basic concepts 2:924
 - magnesium alloys 3:2028
 - pipeline corrosion management 4:3294, 4:3295*f*
 - steel pipes 2:859, 2:859*f*, 2:925*f*
 - steel plates 2:924*f*
 - stress-oriented HIC 4:3295
 - testing methods 2:926
 - titanium/titanium alloys 3:2047
 - hydrogen sources 2:923, 2:924*f*
 - stress-oriented hydrogen-induced cracking (SOHIC)
 - failure mechanisms 2:925
 - general discussion 2:925
 - morphology 2:926*f*
 - testing methods 2:927
- testing methods
 - hydrogen embrittlement 2:926, 2:927*f*
 - hydrogen-induced cracking (HIC) 2:926
 - stress-oriented hydrogen-induced cracking (SOHIC) 2:927
- hydrogen embrittlement 2:902–922
 - acid pickling 2:907, 4:2489
 - aircraft corrosion
 - airframe corrosion 4:3178, 4:3178*t*, 4:3180*t*
 - high-strength steels 4:3182
 - alloys 2:913
 - aluminum alloys 3:1996
 - basic concepts 2:925
 - biomedical devices 2:1317
 - carbon steel 2:1123–1124, 3:1713
 - cleaning processes 2:907
 - composition influences 2:913
 - control options
 - behavior predictions 2:921
 - hydrogen content reduction 2:919
 - steel resistance increases 2:920, 2:920*f*
 - degreasing processes 2:907
 - electroplating processes 2:907
 - general discussion 2:903
 - hydrogen location
 - lattice sites 2:905, 2:905*f*
 - traps 2:905–906, 2:906*t*
 - hydrogen permeation
 - from aqueous phase 2:904, 2:905*f*
 - from gas phase 2:903
 - hydrogen sources 2:907
 - hydrogen transport mechanisms 2:906, 2:907*f*
 - in-service corrosion 2:907, 2:910*f*, 2:911*f*
 - magnesium alloys 3:2028
 - mechanical fasteners 3:2449

- mechanical properties effects
 elastic constants 2:911
 plastic behavior 2:911
 yield stress 2:911
 metallic coatings 4:2523
 microstructural influences 2:913
 modeling approaches 2:921
 nickel-based alloys 2:1136
 niobium and tantalum corrosion 3:2146
 paints and coatings 2:907
 phosphating processes 2:907
 pipeline welds 2:925f
 stainless steels 2:1125, 3:1831, 3:1856
 steels 2:912, 2:912f, 2:913t
 stress corrosion cracking (SCC) 2:890, 2:893f
 terminology 2:903
 testing methods
 constant stress tests 2:916
 controlled strain-rate tests 2:916, 2:917f, 2:918f
 critical stress intensity factor (K_{ISCC}) 2:917, 2:919f
 fracture mechanics tests 2:917, 2:919f
 general discussion 2:915
 hydrogen cracking 2:926, 2:927f
 stress-corrosion tests 2:1541
 theoretical perspectives
 decohesion theories 2:915
 general discussion 2:914
 hydride formation theory 2:915
 local plasticity theories 2:915
 pressure theory 2:914
 surface energy theories 2:915
 welding processes 2:907
 hydrogen (H)
 atmospheric gases 2:1053t
 flue gas composition 1:462t, 1:463t
 fuel chemistry 1:459, 1:459t
 hydrobromic acid (HBr) 2:1207–1225
 aluminum alloys 3:1999f
 characteristics 2:1207
 nickel/nickel alloys 2:1217f
 hydrochloric acid (HCl) 2:1207–1225
 acid pickling 4:2990, 4:2992t
 alumina ceramics 3:2290, 3:2291t, 3:2292f, 3:2302f
 aluminum alloys 3:1999f
 aluminum coatings 4:2564f
 amorphous alloys 3:2193, 3:2193f
 anodic protection 4:2882, 4:2883f
 cast iron corrosion 2:1209, 2:1209f, 3:1765, 3:1765f, 3:1765t
 characteristics 2:1207
 combustion conditions 1:461f
 copper/copper alloys 3:1963
 corrosive environments 1:402
 dry deposition rates 2:1073t
 fiber reinforced plastics (FRPs) 3:2398–2399, 3:2399f
 flue gas composition 1:460t
 glass linings and coatings 3:2324t
 Henry's law coefficients for common gases 2:1056t
 inhibitors 4:2990
 iron–nickel (Fe–Ni) alloys 3:1792, 3:1792t
 lead corrosivity 3:2063
 maraging steels 3:1795
 marine aerosols 2:1059, 2:1061
 nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu)
 alloys 3:1894f
 nickel–chromium–molybdenum (Ni–Cr–Mo) alloys 3:1888f
 nickel/nickel alloys 2:1214f, 2:1215f, 2:1216f, 2:1217f, 2:1218f,
 2:1220f
 niobium corrosion 3:2144, 3:2145f
 noble metal corrosion resistance 3:2216t, 3:2246
 scale inhibitors/dispersants 4:2991, 4:2993t
 stainless steels 2:1211, 2:1211t, 2:1212f, 2:1213f, 3:1840,
 3:1840f
 steel corrosion 2:1209, 2:1209f, 3:1765t
 superheater deposit composition 1:465f
 tantalum corrosion 3:2144, 3:2145f
 tantalum/tantalum alloys 2:1222, 2:1223f
 tin passivation 3:2071
 titanium/titanium alloys 2:1220, 2:1221f
 zirconium corrosivity 3:2118–2119, 3:2120f, 3:2121f, 3:2124t, 3:2128t,
 3:2129t, 3:2130
 hydrofluoric acid (HF) 2:1207–1225
 acid pickling 4:2992, 4:2993t
 alumina ceramics 3:2290, 3:2291t
 aluminum coatings 4:2564f
 characteristics 2:1207
 copper/copper alloys 2:1214f, 3:1963
 corrosive environments 1:403
 electrochemical models 2:1619f
 glasses 3:2313
 inhibitors 4:2990
 nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu)
 alloys 3:1896t, 3:1897t
 nickel/nickel alloys 2:1214f, 2:1219f
 nitric acid–hydrofluoric acid (HNO₃–HF) test 2:1479t, 2:1480f, 2:1480t,
 2:1482
 noble metal corrosion resistance 3:2216t
 noble metals 2:1223
 pH 2:1207–1208, 2:1208f
 production processes 3:1907
 scale inhibitors/dispersants 4:2994
 stainless steel corrosion 2:1212f, 2:1214f
 steel corrosion 2:1210, 2:1210f, 2:1212f
 thermoplastic materials 2:1223
 vitreous silica 3:2315
 zirconium corrosivity 3:2116, 3:2119t
 hydrogen cyanide (HCN) 3:2214, 3:2380t, 4:3217f
 hydrogen evolution 3:1707, 3:2216, 3:2217t, 4:2750, 4:2751f
 hydrogen-induced stress cracking (HISC) 2:859, 2:859f, 3:1833
 hydrogen peroxide (H₂O₂)
 atmospheric gases 2:1055
 dry deposition rates 2:1073t
 radiolytic yields 2:1332t
 stainless steel corrosion 2:1334, 2:1335f
 transport mechanisms 2:1067f
 water radiolysis 2:1331
 zirconium corrosivity 3:2124
 hydrogen sulfide (H₂S)
 aqueous corrosive environments 2:1286
 atmospheric gases 2:1054, 2:1054t
 corrosive environments 2:855f
 dry deposition rates 2:1073t
 environmental conditions 2:1082t
 flue gas composition 1:462t
 gaseous environments 3:2164
 mild steel corrosion 2:1286
 polluted environments 3:1963, 3:1964t, 3:1965f
 process equipment risk management 4:3217f, 4:3219f
 sour corrosion
 general discussion 4:3294
 hydrogen-induced cracking (HIC) 4:3294, 4:3295f
 sulfide stress corrosion cracking (SSCC) 4:3294
 stainless steel corrosion 3:1867
 sulfate-reducing bacteria (SRB) 2:1156, 2:1174, 2:1177f
 sulfidation corrosion
 corrosion mechanisms 1:240, 1:253f
 corrosion rate predictions 1:243, 1:246f, 1:247f, 1:259f
 laboratory simulations 1:245, 1:254f, 1:254t, 1:255f
 parabolic rate constant plot 1:256f
 pressure effects 1:241f, 1:259f, 1:260f
 steam concentration effects 1:260f
 sulfidation/oxidation mechanisms 1:249, 1:250f, 1:255f, 1:256f,
 1:259f, 1:260f
 temperature effects 1:242f
 thermochemical models 1:254f, 1:254t, 1:255f
 sulfide stress cracking (SSC) 2:859, 2:859f, 2:860f, 3:1833, 4:3294
 sweet corrosion 4:3293
 water chemistry 2:1096, 4:2937–2938, 4:2939t
 hydroiodic acid (HI) 2:1207
 lead hydroxide (Pb(OH)₂) 3:2060t
 molecular hydrogen (H₂) 2:1053t
 potassium hydrogen fluoride (KHF) 4:2537t
 process equipment risk management 4:3217f
 rain chemistry 2:1063f
 redox couples equilibrium potential values 1:26t

- hydrogen (H) (*continued*)
 solid oxide fuel cells (SOFCs) 1:488, 1:489*f*, 1:497*r*
 water radiolysis 2:1331, 2:1332*r*
- hydrogen-induced cracking (HIC)
 basic concepts 2:924
 magnesium alloys 3:2028
 pipeline corrosion management 4:3294, 4:3295*f*
 steels
 anhydrous hydrogen halide gases/hydrohalic acids 2:1210–1211
 steel pipes 2:859, 2:859*f*, 2:925*f*
 steel plates 2:924*f*
 stress-oriented HIC 4:3295
 testing methods 2:926
 titanium/titanium alloys 3:2047
- hydrogen stress cracking (HSC) 2:1210–1211
 hydrohalic acids 2:1207
 hydrologic cycle 4:2936, 4:2937*f*
 hydrometallurgy
 copper production 3:1862
 general discussion 3:1861
 nickel production 3:1862
 zinc production 3:1862
- hydroquinone 4:2976–2977, 4:2976*r*
 hydroxyacetic acid (HAA) 3:2130
 hydroxyapatite (Ca₁₀(OH)₂(PO₄)₆) 4:2942*r*
 hydroxyl radical (OH) 1:462*r*, 2:1056*r*, 2:1067*f*
 hydroxypropyl acrylate (HPA) 4:2966
Hylotrupes bajulus 3:2445
 hypotension research 2:1310
- I**
- illite 2:1154
 impact damage 4:2739
 impingement attacks
 characteristics 1:95*r*
 copper/copper alloys 2:1134, 3:1950, 3:1951*f*, 3:1952*r*
 corrosion management 4:3010
 corrosion test methods 2:1489, 2:1490*f*
 industrial heating and cooling systems 4:2948
 potable water systems 4:2948
- impressed current anodes 4:2781–2800
 advantages/disadvantages 4:2806
 applications
 buried structures 4:2817, 4:2819*f*
 concrete structures 4:2798, 4:2815
 general discussion 4:2798
 marine/immersed structures 4:2824*f*, 4:2823, 4:2825*f*, 4:2826*f*
 offshore installations/marine structures 4:2798
 onshore installations 4:2798
 seawater-cooled circulating water systems 4:2822
 seawater-cooled condenser water boxes 4:2798
 ships 4:2825, 4:2827*f*
 water storage tanks 4:2826
- background information 4:2782
 carbonaceous materials
 carbonaceous backfills 4:2789, 4:2790*r*
 conductive overlay systems 4:2791
 conductive paints 4:2792
 conductive polymers 4:2791
 graphite (C) 4:2788, 4:2789*r*
 cast iron 4:2782
 ceramic anodes 4:2785, 4:2797
 characteristics 4:2804*r*, 4:2811
 design guidelines 4:2808*r*
 electrochemical reactions 4:2803
 ferrite anodes 4:2785
 group 1 anodes
 graphite (C) 4:2788, 4:2789*r*, 4:2813, 4:2814*r*
 scrap steel 4:2813, 4:2814*r*
 silicon–iron (Si–Fe) 4:2813, 4:2814*r*
- group 2 anodes
 characteristics 4:2813
 lead–silver (Pb–Ag) alloys 4:2814*r*, 4:2815
 mixed metal oxide-coated titanium (MMO/Ti) anodes 4:2814*r*, 4:2815, 4:2822
 platinized niobium anodes 4:2813, 4:2814*r*
 platinized tantalum anodes 4:2813
 platinized titanium anodes 4:2813, 4:2814*r*
- high silicon iron (HSI)
 high-silicon–chromium iron (Si–Cr Fe) alloys (HSCI) 4:2784
 iron–silicon (Fe–Si) alloys 4:2783
 silicon–molybdenum iron (Si–Mo Fe) alloys 4:2784
- lead-based materials
 lead alloys 4:2786, 4:2787*r*
 lead dioxide (PbO₂)/mixed substrates 4:2788
 lead–magnetite (Pb–Fe₃O₄) composites 4:2788
 lead–platinum (Pb–Pt) bielectrodes 4:2787
 lead–silver (Pb–Ag) alloys 4:2814*r*, 4:2815
 magnetite (Fe₃O₄) anodes 4:2784
 mixed metal oxide-coated titanium (MMO/Ti) anodes 4:2814*r*, 4:2815, 4:2822
 operating characteristics 4:2814*r*
 pipeline corrosion management 4:3288, 4:3288*f*
- platinum anodes
 characteristics 4:2792
 mixed metal oxide (MMO) anodes 4:2796, 4:2798
 platinized niobium anodes 4:2795, 4:2795*r*, 4:2813, 4:2814*r*
 platinized tantalum anodes 4:2795, 4:2795*r*, 4:2813
 platinized titanium anodes 4:2792, 4:2795*r*, 4:2813, 4:2814*r*
- reinforced concrete structures 4:2815
 research developments 4:2831
 seawater-cooled circulating water systems
 continuous anodes 4:2822
 mixed metal oxide-coated titanium (MMO/Ti) anodes 4:2822
 rod anodes 4:2822
 tubular anodes 4:2822
 stainless steels 4:2783
 steel 4:2782
- Incoloy alloys
 characteristics 1:354
 ‘glaze’ formation 1:389, 1:391*f*
 Incoloy 800HT
 characteristics 1:355*r*
 Knoop hardness 1:357*f*
 Nimonic alloys 1:364, 1:366*f*, 1:367*f*
 wear effects 1:355, 1:356*f*, 1:358*f*, 1:359*f*, 1:360*f*, 1:361*f*, 1:363*f*, 1:368*f*
 weight change comparisons 1:355*f*, 1:362*f*
 load effects 1:358, 1:361*f*, 1:362*f*
 wear maps 1:394*f*, 1:395, 1:395*f*
- Inconel alloys
 erosion resistance 2:985*f*
 light water reactors (LWRs) 2:1333
 incorrect coating systems 4:2739
- Incralac™ lacquer 4:3329
 Indian Ocean 2:1109*r*
 indium (In)
 indium oxide (In₂O₃) 3:2197*f*
 pitting corrosion potential 2:782*f*
 sacrificial anodes 4:2768
- industrial electroplating techniques 4:2597
 industrial graphite 3:2272, 3:2275*r*, 3:2276, 3:2277*f*
 industrial heating and cooling systems
 alkalinity 4:2939, 4:2939*r*, 4:2940*r*, 4:2953, 4:2958
 blistering 4:2958*f*
 chemical inhibitors
 cooling systems 4:2964, 4:2965*r*, 4:2968*f*
 general discussion 4:2961
 organic inhibitors 4:2966, 4:2966*f*
 steam boiler systems 4:2961
- contaminant cycles of concentration (COC) 4:2959*r*, 4:2960, 4:2961*r*
 contaminant saturation conditions 4:2956
 corrosion mechanisms
 bacterial growth count evaluation 4:2969*r*
 concentrated cell/crevice corrosion 4:2947
 condensate line corrosion 4:2948
 crevice corrosion 2:766
 erosion 4:2948
 galvanic corrosion 4:2946
 general discussion 4:2945
 grooving corrosion 4:2948
 impingement attacks 4:2948

- microbially-induced corrosion (MIC) 4:2949, 4:2949f, 4:2967, 4:2969t
- microbiological fouling 4:2950, 4:2950f, 4:2967, 4:2969t
- pathogenic bacteria 4:2951, 4:2951f
- pitting corrosion 4:2945, 4:2946f
- stress corrosion 4:2947
- uniform corrosion 4:2945
- white rust 4:2949
- corrosion mitigation 4:2933, 4:2936f
- corrosion monitoring 4:3143
- corrosion rate quantification 4:2957t
- corrosion test coupon 4:2956f
- corrosion vulnerability data 4:2956t
- crevice corrosion
 - heat exchangers and condensers 2:766
 - steam boiler systems 2:766
- freshwater consumption 4:2932, 4:2935f
- hardness 4:2940–2941, 4:2953, 4:2958
- hydrologic cycle 4:2936, 4:2937f
- Langelier saturation index (LSI) 4:2958
- Larson–Skold index (L–SI) 4:2960
- makeup water treatment 4:2959t
- metal and alloy materials selection 4:2955, 4:2956t
- mineral scales, muds, and sludges
 - chemical compositions 4:2942t
 - closed-loop water systems 4:2943
 - cooling systems 4:2943, 4:2943f
 - general discussion 4:2941
 - new-construction HVAC systems 4:2944
 - potable water lines 4:2944
 - steam boiler systems 4:2941, 4:2942f
 - pretreatment processes 4:2953, 4:2954f
- Puckorius scaling index (PSI) 4:2959
- Ryznar stability index (RSI) 4:2959
- scale formation 4:2935, 4:2936f
- treatment guidelines 4:2952
- water chemistry 4:2936, 4:2939t
- water treatment factors 4:2933
- industrial rubber goods (IRGs) 3:2411, 3:2412t
- inert/extender pigments 4:2653
- inert fillers 3:2355
- inert plasma spraying (IPS) 4:2615
- infrared spectroscopy
 - attenuated total reflection spectroscopy
 - basic concepts 2:1402
 - characteristics 2:1376t
 - basic concepts 2:1402, 2:1426
 - characteristics 2:1376t
 - IR reflection absorption spectroscopy (IRRAS)
 - basic concepts 2:1403
 - characteristics 2:1376t
 - tin analyses 3:2071
- infrastructure systems 4:3198–3206
 - background information 4:3198
 - degradation mechanisms 4:3198
 - failure consequences 4:3199
 - highway infrastructure 4:3200f, 4:3201f, 4:3202f, 4:3203
 - inspection requirements
 - bridge half-joint diagram 4:3200f
 - electromagnetic covermeter 4:3202f
 - half-cell potential surveys 4:3201, 4:3202f
 - importance 4:3199
 - inspection equipment 4:3201f, 4:3202f
 - methodologies 4:3200
 - remote monitoring methods 4:3203
 - structural factors 4:3203
 - lighting and signage posts 4:3205
 - parking structures 4:3204, 4:3205f
- inhibitive pigments 4:2652, 4:2995t, 4:2996
- inhibitor release coatings 4:2646f, 4:2649, 4:3332, 4:3333f
- inhibitors 4:2990–3000
 - acid pickling 4:2990
 - acid solutions 4:2990
 - aluminum alloys 3:2001
 - anodic/cathodic inhibitors 4:2996
 - chemical inhibitors
 - industrial heating and cooling systems
 - cooling systems 4:2964, 4:2965t, 4:2968f
 - general discussion 4:2961
 - steam boiler systems 4:2961
 - potable water systems
 - cast iron 3:1757
 - cooling systems 4:2964, 4:2965t, 4:2968f
 - general discussion 4:2961
 - steam boiler systems 4:2961
 - water treatment 2:1104
 - construction materials 4:2996
 - corrosion test methods
 - immersed conditions 2:1511, 2:1512f
 - vapor phase conditions 2:1513
 - cultural heritage preservation
 - benzotriazole (BTA) 4:3332, 4:3333f
 - carboxylates 4:3334
 - general discussion 4:3332
 - tannins 4:3334, 4:3335f
 - galvanic corrosion 2:844
 - mild steel 2:1284
 - mining industry 4:2994
 - oil and gas industry
 - adsorption inhibition processes 4:2909f, 4:2910f, 4:2908
 - chemical treatments 4:2905f, 4:2903
 - inhibitor performance analysis 4:2910f, 4:2910
 - inhibitor testing
 - autoclave tests 4:2914
 - bubble tests 4:2911
 - compatibility tests 4:2915f, 4:2914
 - field deployment tests 4:2914
 - general discussion 4:2911
 - jet impingement tests 4:2914
 - persistency tests 4:2913f, 4:2913
 - rotating cylinder electrode (RCE)/flow loops tests 4:2912f, 4:2912
 - weld corrosion 4:2914f, 4:2915f, 4:2914
 - scale inhibition/control
 - chemical treatments 4:2917t, 4:2916
 - control mechanisms 4:2917
 - general discussion 4:2916
 - inhibitor material selection 4:2919
 - inhibitor treatments 4:2916
 - removal methods 4:2919
 - scale formation 4:2916f
 - scale prediction models 4:2919f, 4:2917
 - squeeze treatments 4:2921f, 4:2919
 - oil wells 4:2994, 4:2994t
 - organic inhibitors
 - construction materials 4:2997–2998
 - industrial heating and cooling systems 4:2966, 4:2966f
 - mining industry 4:2994
 - oil and gas industry 4:2917t, 4:2908, 4:2916
 - potable water systems 4:2966
 - packaging materials 4:2997
 - paints and organic coatings 4:2995, 4:2995t
 - petrochemical/chemical industries 4:3213
 - pickling inhibitors
 - basic concepts 4:2990
 - characteristics 4:2992t
 - hydrofluoric acid (HF) 4:2993t
 - inorganic inhibitors 4:2490
 - nitric acid (HNO₃) 4:2993t
 - organic inhibitors 4:2489, 4:2490f
 - phosphoric acid (H₃PO₄) 4:2993t
 - sulfuric acid (H₂SO₄) 4:2992t
 - pipeline corrosion management 4:3296
 - pitting corrosion 2:779, 2:780t
 - protective barrier inducement (PBI)
 - aqueous acidic solutions 4:2895, 4:2896f, 4:2897f
 - aqueous near-neutral solutions 4:2897, 4:2898f, 4:2899f
 - basic concepts 4:2894
 - rust inhibitors 2:1303t
 - scale inhibitors/dispersants 2:1104, 4:2991, 4:2993t
 - vapor phase corrosion inhibitors 4:2997
 - volatile corrosion inhibitors 4:2679t, 4:2680
- inorganic inhibitors 4:2490
- inorganic salts

- inorganic salts (*continued*)
 aluminum alloys 3:1999
 anodic protection
 ammonium nitrate (NH_4NO_3) 4:2883
 chloride compounds 4:2883
 phosphate compounds 4:2883
 sulfate compounds 4:2883
 thiocyanate compounds 4:2883
 insects 3:2441, 3:2445
 insulating firebricks 3:2340
 Intelligent Pig pipeline inspections
 general discussion 2:1573
 tracked feature depths 2:1573, 2:1574f
 untracked features/pareto distribution analysis 2:1573, 2:1573f
 intercellular fluids 2:1312f
 intergranular corrosion 2:810–827
 airframe corrosion 4:3177, 4:3178t, 4:3180t
 aluminum alloys 2:795, 2:796t, 2:814, 2:821t, 3:1992, 3:1993f
 basic concepts
 general discussion 2:810
 grain boundary attack susceptibility 2:813, 2:813f
 grain boundary structure and network 2:812
 grain drooping 2:811f
 metallurgical aspects 2:812
 theoretical aspects 2:811
 characteristics 1:95t, 2:866f
 copper/copper alloys 2:820
 heat exchangers and condensers 2:766
 intergranular stress corrosion cracking (IGSCC)
 anodic models 2:886
 characteristics 2:865, 2:866f
 electron backscatter diffraction (EBSD) 2:882f
 environmental conditions 2:885, 2:887f
 film-induced cleavage 2:892, 2:894f
 grain boundaries 2:873–874, 2:877f
 metallurgical factors 2:872
 modeling approaches 2:895–896, 2:897f
 predictive modeling 2:1669
 slip dissolution 2:890
 temperature dependence effects 2:897f
 yield strength 2:893f
 nickel/nickel alloys 2:819, 2:823t, 2:825t
 stainless steels
 anodic polarization curves 2:816f
 austenitic–ferritic (duplex) stainless steels 2:818
 characteristics 3:1845
 degree of sensitization tests 2:825f, 2:825t
 electrochemical potentiokinetic reactivation (EPR) tests 2:823, 2:825f, 2:825t
 ferritic stainless steels 2:818
 general discussion 2:815
 knife line attacks 2:818
 martensitic stainless steels 2:818
 polarization curves 2:824f
 precipitation hardenable stainless steels 2:819
 sensitization conditions 2:815, 2:815f, 2:816f, 2:817f
 sensitization prevention 2:817
 standard practices and test methods 2:822t, 2:824f
 time–temperature–precipitation (TTP) diagram 2:816, 2:817f, 2:818f
 time–temperature–sensitization (TTS) diagram 3:1845f
 weld decay 2:818, 2:818f
 testing procedures
 degree of sensitization tests 2:823, 2:825f, 2:825t
 electrochemical potentiokinetic reactivation (EPR) tests 2:823, 2:825f, 2:825t
 general discussion 2:820
 microstructure screening 2:823
 standard practices and test methods
 aluminum alloys 2:821t
 general discussion 2:820
 nickel/nickel alloys 2:823t, 2:825t
 stainless steels 2:822t, 2:824f
 zinc/zinc alloys 2:820, 3:2091
 zirconium/zirconium alloys 3:2107, 3:2108f
 intermetallic alloys 1:646–667
 applications 1:646
 coatings
 aluminide coatings
 alloyed aluminide coatings 1:663, 1:664f, 1:665f
 different base–different substrate 1:665, 1:665f
 gas turbines 1:537f
 high-temperature coatings 1:701, 1:701f
 platinum aluminides 4:2544, 4:2545f, 4:2546f, 4:2547f, 4:2549f
 same base–same substrate 1:663
 simple aluminide coatings 1:663
 general discussion 1:662
 laser cladding (LC) 4:2624, 4:2633t
 thermal barrier coatings
 aeroengine applications 1:704f
 characteristics 1:664–665, 1:704
 chemical failures 1:719, 1:719f, 1:720f
 cross-section diagram 1:705f
 failure characteristics 1:713, 1:714f, 1:715f, 1:716f
 martensite formation 1:717
 mechanical instabilities 1:716f, 1:717
 oxidation-induced failure 1:712
 schematic cross-section diagram 1:705f
 strain energy 1:715
 subcritical crack growth 1:716, 1:721f
 surface roughness 1:718, 1:719f, 1:720, 1:720f, 1:721f
 time-to-failure data plot 1:713f
 topcoat cracking 1:716f, 1:721f
 transformation strains 1:716
 common intermetallic alloys
 crystal structure 1:648f
 general discussion 1:646
 iron aluminides (FeAl/Fe₃Al)
 alumina scale formation 1:654
 characteristics 1:648
 chlorine-containing environments 1:661
 compositions 1:609t
 crystal structure 1:648f
 metal dusting 1:292
 microstructure 1:651
 partial pressure effects 1:654
 phase diagram 1:650f
 porosity 1:651
 reactive element additions 1:227t, 1:655
 scale adhesion 1:223
 scale properties 1:650
 sulfur-containing environments 1:660
 sulfur impurities 1:230, 1:231f, 1:654–655
 water vapor effects 1:654
 nickel aluminides (NiAl/Ni₃Al)
 alumina scale formation 1:547f, 1:623f, 1:652f, 1:654f
 aluminide coatings 1:665, 1:665f, 3:2188
 characteristics 1:646
 chlorine-containing environments 1:661
 coefficients of thermal expansion (CTEs) 1:632f
 compositions 1:609t
 crystal structure 1:104, 1:648f
 dislocations 1:106–107
 internal oxidation 1:633
 microstructure 1:651
 parabolic rate constants 1:624t
 partial pressure effects 1:654
 phase diagram 1:649f
 porosity 1:651
 reactive element additions 1:227t, 1:655
 scale adhesion 1:223
 scale properties 1:650
 sulfur-containing environments 1:660
 sulfur impurities 1:230, 1:231f, 1:654–655
 water vapor effects 1:637, 1:638f, 1:654
 titanium aluminides (TiAl/Ti₃Al)
 alloyed aluminide coatings 1:665, 1:697
 characteristics 1:649
 chlorine-containing environments 1:661, 1:662f
 crystal structure 1:648f
 different base–different substrate coatings 1:665
 general discussion 1:656
 microstructure 1:657–658
 nitrogen influences 1:657
 phase diagram 1:651f

- pretreatment options 1:658
 - reactive element additions 1:658, 1:659f
 - scale properties 1:656, 1:656f
 - sulfur-containing environments 1:660, 1:661f
 - uranium alloys 3:2188
 - water vapor effects 1:658
 - copper–gold (Cu–Au) alloys 2:805f, 2:867t, 3:2215
 - general discussion 1:646, 1:666
 - high-temperature tribocorrosion
 - characteristics 1:359
 - silicon nitride (SiN/Si₃N₄) 1:355f, 1:360f, 1:364f, 1:365f, 1:371, 1:372f
 - titanium–aluminum (Ti–Al)–ceramic counterfaces 1:362, 1:365f
 - titanium–aluminum (Ti–Al)–metallic counterfaces 1:360, 1:363f, 1:364f
 - hot corrosion
 - alumina-forming alloys 1:638
 - chlorine-containing environments
 - gaseous environments 1:661
 - molten salts 1:662, 1:662f
 - general discussion 1:660
 - sulfur-containing environments
 - gaseous environments 1:660
 - molten salts 1:661, 1:661f
 - metal–matrix composites 3:2263, 3:2263t
 - oxidation processes
 - Ellingham diagram 1:652f
 - general discussion 1:649
 - iron aluminides (FeAl/Fe₃Al)
 - alumina scale formation 1:654
 - microstructure 1:651
 - partial pressure effects 1:654
 - porosity 1:651
 - reactive element additions 1:227t, 1:655
 - scale properties 1:650
 - sulfur impurities 1:654–655
 - water vapor effects 1:654
 - nickel aluminides (NiAl/Ni₃Al)
 - alumina scale formation 1:547f, 1:623f, 1:652f, 1:654f
 - microstructure 1:651
 - porosity 1:651
 - reactive element additions 1:227t
 - scale properties 1:650
 - platinum aluminides 1:227t, 1:659
 - titanium aluminides (TiAl/Ti₃Al)
 - general discussion 1:656
 - microstructure 1:657–658
 - nitrogen influences 1:657
 - pretreatment options 1:658
 - reactive element additions 1:658, 1:659f
 - scale properties 1:656, 1:656f
 - water vapor effects 1:658
 - silver–gold (Ag–Au) alloys 2:803f, 2:805f, 2:806f, 2:867t, 3:2215
 - structural metallurgy 1:63
 - sulfur (S)
 - hot corrosion
 - gaseous environments 1:660
 - molten salts 1:661, 1:661f
 - impurities 1:230, 1:231f, 1:654–655
 - internal combustion engine lubricants 2:1304
 - internal rotary inspection system (IRIS) 4:3152, 4:3153f
 - interstitial fluids 2:1312f
 - intragranular corrosion
 - anodic protection 4:2863
 - nickel–iron–chromium (Ni–Fe–Cr) alloys
 - corrosion testing
 - background information 2:1478
 - boiling nitric acid (HNO₃) test (Huey test) 2:1478, 2:1479t, 2:1480f
 - boiling sulfuric acid/copper sulfate (H₂SO₄/CuSO₄) tests 2:1479t, 2:1480f, 2:1481, 2:1482f
 - electrochemical potentiokinetic reactivation (EPR) test 2:1485, 2:1486f
 - electrochemical tests 2:1483, 2:1484f
 - electrolytic oxalic acid etching test 2:1483, 2:1483f, 2:1484f
 - maximum acceptable evaluation test rates 2:1480t
 - nitric acid–hydrofluoric acid (HNO₃–HF) test 2:1479t, 2:1480f, 2:1480t, 2:1482
 - sulfuric acid–iron sulfate (H₂SO₄–FeSO₄) test (Streicher test) 2:1479t, 2:1480f, 2:1480t, 2:1482
 - test potentials 2:1480f
 - test summary 2:1479t
 - nitric acid (HNO₃) 2:1255, 2:1256f
 - stress corrosion cracking (SCC) 2:877f
 - intrinsically conducting polymers (ICPs) 2:994
 - intrinsic diffusion 1:118
 - intrinsic oxide scale growth
 - chromia (Cr₂O₃) scale growth 1:160f
 - experimental observations 1:155, 1:156f
 - mass change–time plot 1:156f
 - modeling methods 1:160
 - nickel oxide (NiO) 1:158f, 1:159t
 - parabolic stages 1:156f
 - Pilling–Bedworth ratio (PBR) 1:146t, 1:160, 1:160t
 - stress curve growth–time plot 1:158f
 - stress growth measurements 1:159t
 - wave formation 1:156f
 - inverse-logarithmic law 1:137
 - inward growth diffusion coatings 4:2537, 4:2539f
 - iodine (I)
 - corrosion potential 2:1261
 - high-temperature stainless steels 3:1876
 - hydroiodic acid (HI) 2:1207
 - pitting corrosion 2:774t
 - water chemistry 2:1098, 2:1098t
 - ionized point defects 1:112
 - ionizing radiation 2:1330–1340
 - characteristics 2:1330
 - corrosion effects
 - aqueous environments
 - chemical plant heating/cooling waters 2:1334
 - general discussion 2:1332
 - light water reactors (LWRs) 2:1333, 2:1333f
 - nitric acid solutions 2:1337
 - polymer degradation materials 2:1337
 - stainless steel corrosion 2:1334, 2:1334t, 2:1335f, 2:1336f
 - atmospheric environments 2:1337
 - environment
 - general discussion 2:1331
 - water radiolysis 2:1331, 2:1332t
 - metals 2:1331
 - surface films 2:1331
 - test considerations 2:1338
- ion scattering spectrometry (ISS)
 - basic concepts 2:1385
 - characteristics 2:1376t
 - depth profile 2:1385f
 - passive film analysis 3:1923
 - ultrahigh vacuum (UHV) conditions 2:1376
- ion spectrometry
 - general discussion 2:1385
- ion scattering spectrometry (ISS)
 - basic concepts 2:1385
 - characteristics 2:1376t
 - depth profile 2:1385f
 - ultrahigh vacuum (UHV) conditions 2:1376
- Rutherford back scattering (RBS) spectrometry
 - basic concepts 2:1386
 - characteristics 2:1376t
 - spectral data plot 2:1386f
 - ultrahigh vacuum (UHV) conditions 2:1376
- secondary ion mass spectrometry (SIMS)
 - basic concepts 2:1387
 - characteristics 2:1376t
 - corrosion product characterizations 1:140, 1:142f
 - ultrahigh vacuum (UHV) conditions 2:1376
- IR drop
 - crevice corrosion 2:756, 2:756f
 - electrochemical cells 2:1464, 2:1464f
 - electrochemical theory 2:836f, 2:845
 - structure/electrolyte potential measurement 4:2841
- iridium (Ir)
 - alumina-forming alloys 1:616
 - corrosion resistance 3:2216t
 - exchange current density 3:2217t
 - high-temperature properties 3:2217, 3:2218t
 - intermetallic alloys 1:659

- iridium (Ir) (*continued*)
 platinum-iridium (Pt-Ir) alloys 3:2209
 properties 3:2207*t*, 3:2208
 supply/demand estimations 3:2207*t*
 thermodynamic behavior 3:2210
- iroko 2:1325*t*
- iron (Fe)
 acid pickling
 hydrochloric acid (HCl) 4:2992*t*
 hydrofluoric acid (HF) 4:2993*t*
 age-hardenable nickel-chromium-iron-molybdenum-copper (Ni-Cr-Fe-Mo-Cu) alloys 3:1898
 amorphous alloys 3:2193, 3:2193*f*
 archaeological metals 2:1159, 4:3311, 4:3311*f*, 4:3312*f*
 atmospheric corrosion
 atmospheric corrosivity classifications 3:1725, 3:1726*t*, 3:1727*t*
 corrosion kinetics
 climatic variation 3:1720, 3:1721*t*
 corrosion rates 3:1722, 3:1722*f*, 3:1723*t*
 exposure conditions 3:1721
 corrosion mechanisms
 acid regeneration cycle 3:1718
 electrochemical mechanisms 3:1719
 wet/dry cycles 3:1719, 3:1720*f*
 corrosion product composition 3:1719
 environmental influences
 air-borne pollutants 3:1715, 3:1715*t*, 3:1716*f*
 particulate matter 3:1715*f*, 3:1717, 3:1718*t*
 relative humidity (RH) 3:1714, 3:1715*f*, 3:1715*t*
 sea salt 3:1718*t*
 weathering steels
 alloying effects 3:1720*f*, 3:1722*f*, 3:1723, 3:1724*f*
 applications 3:1724
 next generation weathering steels 3:1725, 3:1725*t*
 wet/dry cycles 3:1723, 3:1725*f*
- cast iron 3:1737-1788
 alkali corrosion 2:1192, 2:1196*f*
 alloy cast irons 3:1740
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209, 2:1209*f*
 anodic protection 4:2876
 applications
 alloyed ferritic cast irons 3:1748, 3:1748*f*, 3:1756*f*, 3:1767*t*, 3:1770*t*, 3:1771*f*
 austenitic cast irons 3:1748, 3:1749*t*, 3:1764*f*, 3:1768*f*, 3:1784*t*
 unalloyed cast irons 3:1747, 3:1785*t*, 3:1786*t*
 characteristics 3:1739
 compositions 3:1741*t*
 corrosion behavior
 austenitic nickel cast iron 3:1744, 3:1744*f*, 3:1745*t*, 3:1756*t*
 high-alloy cast irons 3:1744
 high chromium cast iron 3:1746, 3:1748*f*, 3:1764*f*
 high silicon cast iron 3:1746, 3:1747*t*, 3:1748*t*
 low-alloy lamellar cast irons 3:1742*f*, 3:1743, 3:1752*f*, 3:1759*t*
 spheroidal graphite cast irons 3:1743, 3:1759*t*
 sulfuric acid (H₂SO₄) effects 3:1743*f*
 corrosion rates 2:1196*f*
 corrosion removal methods 4:3321-3322
 corrosive environments
 atmospheric corrosion 3:1750, 3:1751*t*, 3:1752*f*, 3:1752*t*
 gaseous environments 3:1780
 high-temperature oxidation 3:1780, 3:1781*f*, 3:1782*f*, 3:1783*f*, 3:1784*f*
 industrial environments 3:1763
 natural waters 3:1752
 nickel-resist cast irons 3:1750, 3:1753*f*, 3:1753*t*, 3:1760*f*, 3:1761*f*, 3:1762*t*, 3:1761*f*, 3:1765*t*
 protective measures 3:1762
 seawater 2:1125, 2:1125*t*, 3:1758
 soil corrosion 3:1760, 3:1762*t*
 steam corrosion 3:1757
 urban/rural/marine atmospheres 3:1751*t*
- ductile cast iron 3:1740, 3:1740*f*, 3:1752*t*, 3:1769*t*
- erosion resistance 2:985*f*
- flow-induced corrosion
 cavitation 3:1777, 3:1777*t*
 erosion corrosion 3:1778, 3:1779*f*, 3:1780*f*, 3:1780*t*
 galvanic corrosion 2:831*f*, 2:849*f*, 2:851*t*, 2:982*f*, 2:1119*f*, 3:1845*f*
 galvanic coupling effects 3:1743, 3:1756, 3:1757*t*
- gaseous environments
 chlorine gas 3:1784, 3:1784*t*
 gaseous mixtures 3:1785*t*, 3:1786*t*
 gas transport and distribution pipes 3:1784
 high-temperature oxidation 3:1780, 3:1781*f*, 3:1782*f*, 3:1783*f*, 3:1784*f*
 hydrogen sulfide (H₂S) 3:1783, 3:1784*t*
 sulfur dioxide (SO₂) 3:1783
- gray cast iron 3:1739, 3:1739*f*, 3:1741*f*, 3:1751*t*, 3:1756*t*, 3:1759*t*, 3:1769*t*, 3:1773*t*
- historical background 3:1695
- impressed current anodes 4:2782
- industrial environments
 alcohol corrosion 3:1772, 3:1773*t*
 alkali corrosion 3:1767, 3:1767*f*, 3:1768*f*, 3:1768*t*
 corrosion fatigue 3:1768, 3:1769*t*, 3:1770*f*, 3:1770*t*, 3:1771*f*, 3:1772*f*
 food product corrosion 3:1773, 3:1773*t*
 general discussion 3:1763
 glycol corrosion 3:1772, 3:1773*t*
 hydrochloric acid (HCl) corrosion 3:1765, 3:1765*f*, 3:1765*t*
 mineral acid corrosion 3:1766
 nitric acid (HNO₃) corrosion 3:1765, 3:1766*f*
 organic acid corrosion 3:1766, 3:1767*t*
 organic compound corrosion 3:1772
 phosphoric acid (H₃PO₄) corrosion 3:1765, 3:1766*f*, 3:1767*t*
 salt solutions 3:1768, 3:1768*t*, 3:1769*t*
 stress corrosion cracking (SCC) 3:1770, 3:1772*f*
 sulfuric acid (H₂SO₄) corrosion 3:1761*f*, 3:1762*f*, 3:1763, 3:1764*f*
 malleable cast iron 3:1740, 3:1751*t*, 3:1752*t*
- marine corrosion
 corrosion rates 2:1125*t*, 3:1759*t*, 3:1760*f*, 3:1760*t*, 3:1761*f*, 3:1762*t*, 3:1761*f*
 general discussion 2:1125, 3:1758
 gray cast iron corrosion rates 3:1759*t*
 sodium chloride (NaCl) concentration effects 3:1758*f*
- microbially-induced corrosion (MIC)
 action mechanisms 3:1775
 gelatinous vesicle development 3:1775, 3:1776*f*
 general discussion 3:1774
 iron-oxidizing bacteria 3:1775
 prevention strategies 3:1776
 sulfate-reducing bacteria (SRB) 3:1775
- microstructural effects 3:1741, 3:1741*f*, 3:1742*f*
- molten materials
 liquid aluminum/aluminum alloys 3:1773
 liquid metals 3:1774
 liquid sulfur corrosion 3:1774, 3:1774*t*
 liquid zinc/zinc alloy corrosion 3:1774
- production processes 3:1740
- soil corrosion 2:1152*f*
 standard reduction potential 3:2074*t*
 stress growth measurements 1:159*t*
 sulfate-reducing bacteria (SRB) 2:1175, 2:1176*f*
 sulfuric acid (H₂SO₄)
 anodic polarization curves 2:1229*f*
 anodic protection 4:2876
 corrosion rates 2:1228, 2:1228*f*, 3:1743*f*, 3:1761*f*, 3:1763, 3:1764*f*
 high chromium cast iron 3:1764*f*
 iso-corrosion curve plot 3:1762*f*, 3:1764*f*
 silicon-based cast iron 3:1764*f*
- unalloyed cast irons
 alkali corrosion 3:1768*f*, 3:1768*t*
 characteristics 3:1747
 corrosion rates 3:1760*f*, 3:1761*f*
 hydrogen sulfide (H₂S) corrosion 3:1784*t*
 natural water corrosion 3:1756*t*
 seawater corrosion 3:1759*t*
 vitreous enamel coatings 3:2331
 white cast iron 3:1739, 3:1751*t*
- corrosion potential 2:1261, 2:1262*f*, 2:1263*f*
- corrosion protection methods
 paints and organic coatings
 anodic reactions 4:2669
 cathodic reactions 4:2667
 oxygen diffusion 4:2668, 4:2668*t*
 water diffusion 4:2668, 4:2668*t*
 tannins 4:3334, 4:3335*f*

- corrosion test methods 2:1479*t*, 2:1480*f*; 2:1480*t*, 2:1482
- corrosion vulnerability data 4:2956*t*
- corrosive environments 1:92
- crystal structure 1:55*t*
- electrochemical scanning tunnel microscopy (ECSTM) 2:1436
- electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*
- Ellingham diagram 1:652*f*
- exchange current density 3:2217*t*
- filiform corrosion 2:1000, 2:1001*f*; 2:1002*f*
- fuel chemistry 1:459, 1:459*t*
- galvanic corrosion 2:850*t*
- hematite (Fe₂O₃) 1:128
- high silicon iron (HSI)
- high-silicon–chromium iron (Si–Cr Fe) alloys (HSCI) 4:2784
 - iron–silicon (Fe–Si) alloys 4:2783
 - silicon–molybdenum iron (Si–Mo Fe) alloys 4:2784
 - sulfuric acid (H₂SO₄) corrosion 2:1230
- historical background 3:1695
- iron alloys
- alumina-forming alloys 1:606–645
 - breakaway oxidation 1:634
 - compositions 1:607, 1:608*t*, 1:609*t*
 - creep rupture life 1:611*f*
 - environmental conditions 1:637
 - functionality 1:609*t*
 - general discussion 1:640
 - hydrogen permeability 1:612*f*
 - selective oxidation 1:612
 - spalled oxide mass 1:610*f*, 1:617*f*
 - steady-state oxidation 1:621
 - total mass gain 1:607, 1:610*f*; 1:614*f*, 1:617*f*
 - transient oxidation 1:617
 - austenitic iron–nickel (Fe–Ni) alloys 1:296, 1:297
 - carburation
 - dissolution thermodynamics 1:275*t*
 - permeability data 1:276*t*
 - reaction morphologies 1:276
 - thermodynamic properties 1:276
 - cast iron 3:1737–1788
 - alcohol corrosion 3:1772, 3:1773*t*
 - alkali corrosion 2:1192, 2:1196*f*; 3:1767, 3:1767*f*; 3:1768*f*; 3:1768*t*
 - alloy cast irons 3:1740
 - alloyed ferritic cast irons 3:1748, 3:1748*f*; 3:1756*f*; 3:1767*t*, 3:1770*t*, 3:1771*f*
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1209, 2:1209*f*
 - anodic protection 4:2876
 - atmospheric corrosion 3:1750, 3:1751*t*, 3:1752*f*; 3:1752*t*
 - austenitic cast irons 3:1748, 3:1749*t*, 3:1764*f*; 3:1768*f*; 3:1784*t*
 - austenitic nickel cast iron 3:1744, 3:1744*f*; 3:1745*t*, 3:1756*t*
 - cavitation corrosion 3:1777, 3:1777*t*
 - characteristics 3:1739
 - compositions 3:1741*t*
 - corrosion fatigue 3:1768, 3:1769*t*, 3:1770*f*; 3:1770*t*, 3:1771*f*; 3:1772*f*
 - corrosion rates 2:1196*f*
 - corrosion removal methods 4:3321–3322
 - ductile cast iron 3:1740, 3:1740*f*; 3:1752*t*, 3:1769*t*
 - erosion corrosion 3:1778, 3:1779*f*; 3:1780*f*; 3:1780*t*
 - erosion resistance 2:985*f*
 - flow-induced corrosion 3:1777
 - food product corrosion 3:1773, 3:1773*t*
 - galvanic corrosion 2:831*f*, 2:849*f*; 2:851*t*, 2:982*f*; 2:1119*f*, 3:1845*f*
 - galvanic coupling effects 3:1743, 3:1756, 3:1757*t*
 - gaseous environments 3:1780
 - glycol corrosion 3:1772, 3:1773*t*
 - gray cast iron 3:1739, 3:1739*f*; 3:1741*f*; 3:1751*t*, 3:1756*t*, 3:1759*t*, 3:1769*t*, 3:1773*t*
 - high-alloy cast irons 3:1744
 - high chromium cast iron 3:1746, 3:1748*f*; 3:1764*f*
 - high silicon cast iron 3:1746, 3:1747*t*, 3:1748*t*
 - high-temperature oxidation 3:1780, 3:1781*f*; 3:1782*f*; 3:1783*f*; 3:1784*f*
 - historical background 3:1695
 - hydrochloric acid (HCl) corrosion 3:1765, 3:1765*f*; 3:1765*t*
 - impressed current anodes 4:2782
 - industrial environments 3:1763
 - iron-oxidizing bacteria 3:1775
 - liquid aluminum/aluminum alloy corrosion 3:1773
 - liquid metals 3:1774
 - liquid sulfur corrosion 3:1774, 3:1774*t*
 - liquid zinc/zinc alloy corrosion 3:1774
 - low-alloy lamellar cast irons 3:1742*f*; 3:1743, 3:1752*f*; 3:1759*t*
 - malleable cast iron 3:1740, 3:1751*t*, 3:1752*t*
 - marine corrosion 2:1125, 2:1125*t*
 - microbially-induced corrosion (MIC) 3:1774
 - microstructural effects 3:1741, 3:1741*f*; 3:1742*f*
 - mineral acid corrosion 3:1766
 - molten materials corrosion 3:1773
 - natural water corrosion 3:1752
 - nickel-resist cast irons 3:1750, 3:1753*f*; 3:1753*t*, 3:1760*f*; 3:1761*f*, 3:1762*t*, 3:1761*f*; 3:1765*t*
 - nitric acid (HNO₃) corrosion 3:1765, 3:1766*f*
 - organic acid corrosion 3:1766, 3:1767*t*
 - organic compound corrosion 3:1772
 - phosphoric acid (H₃PO₄) corrosion 3:1765, 3:1766*f*; 3:1767*t*
 - production processes 3:1740
 - protective measures 3:1762
 - salt solutions 3:1768, 3:1768*t*, 3:1769*t*
 - seawater corrosion 2:1125, 2:1125*t*, 3:1758
 - soil corrosion 2:1152*f*; 3:1760, 3:1762*t*
 - spheroidal graphite cast irons 3:1743, 3:1759*t*
 - standard reduction potential 3:2074*t*
 - steam environments 3:1757
 - stress corrosion cracking (SCC) 3:1770, 3:1772*f*
 - stress growth measurements 1:159*t*
 - sulfate-reducing bacteria (SRB) 2:1175, 2:1176*f*; 3:1775
 - sulfuric acid (H₂SO₄) 2:1228, 2:1228*f*; 2:1229*f*
 - sulfuric acid (H₂SO₄) corrosion 3:1761*f*; 3:1762*f*; 3:1763, 3:1764*f*
 - sulfuric acid (H₂SO₄) effects 3:1743*f*
 - unalloyed cast irons 3:1747, 3:1756*t*; 3:1760*f*; 3:1761*f*; 3:1768*f*; 3:1768*t*, 3:1784*t*, 3:1785*t*, 3:1786*t*
 - urban/rural/marine atmospheres 3:1751*t*
 - vitreous enamel coatings 3:2331
 - white cast iron 3:1739, 3:1751*t*

comparison studies 1:595*t*

compositions 1:246*t*

corrosion fatigue 2:944

diffusion coefficients 1:307*t*

ferritic chromium steels

 - anodic polarization curves 2:1231*f*
 - erosion resistance 2:985*f*
 - flow-induced corrosion 2:982*f*
 - metal dusting 1:291, 1:292*f*; 1:293*f*
 - solid oxide fuel cells (SOFCs) 1:492, 1:494*t*, 1:495*f*; 1:496*f*; 1:499, 1:501*t*

high-silicon–chromium iron (Si–Cr Fe) alloys (HSCI) 4:2784

Incoloy alloys 1:354

iron–40% chromium–platinum-group metals (Fe–40% Cr–PGM) system 3:2243

iron aluminides (FeAl/Fe₃Al)

 - alumina scale formation 1:654
 - characteristics 1:648
 - chlorine-containing environments 1:661
 - compositions 1:609*t*
 - crystal structure 1:648*f*
 - metal dusting 1:292
 - microstructure 1:651
 - partial pressure effects 1:654
 - phase diagram 1:650*f*
 - porosity 1:651
 - reactive element additions 1:227*t*, 1:655
 - scale adhesion 1:223
 - scale properties 1:650
 - sulfur-containing environments 1:660
 - sulfur impurities 1:230, 1:231*f*; 1:654–655
 - water vapor effects 1:654

iron–aluminum (Fe–Al) alloys 1:292, 1:452, 1:613*f*; 1:636*f*

iron- and nickel-based superalloys 1:310, 1:311*f*

iron–carbon (Fe–C) alloys

 - equilibrium microstructures 3:1697, 3:1698*f*
 - mechanical properties 3:1699, 3:1699*t*
 - nonequilibrium microstructures 3:1697, 3:1698*f*
 - phase diagram 3:1695, 3:1696*f*
 - physical properties 3:1699, 3:1699*t*

iron–chromium–aluminum (Fe–Cr–Al) alloys

 - alloy grain size effects 1:616*f*

- iron (Fe) (*continued*)
- base metal oxide formation 1:619*f*
 - cubic alumina phases 1:620*f*, 1:621*f*
 - cycle frequency effects 1:632, 1:632*f*, 1:633*f*
 - internal oxidation 1:633, 1:634*f*
 - metal dusting 1:292
 - nitridation processes 1:639
 - parabolic rate constants 1:622*t*, 1:624*t*
 - reactive element additions 1:227*t*
 - scale adhesion 1:628*f*
 - scale growth rate 1:546*f*, 1:621, 1:622*f*, 1:623*f*
 - scale morphology 1:626, 1:627*f*
 - specimen mass gain 1:623*f*
 - sulfidation 1:552*f*, 1:638
 - sulfur impurities 1:230, 1:231*f*
 - water vapor effects 1:637
- iron–chromium (Fe–Cr) alloys
- breakaway oxidation mechanisms 1:428*f*, 1:430
 - carbide precipitation zones 1:278*f*
 - carburization diffusion paths 1:278*f*
 - carburization kinetics 1:277, 1:279*f*, 1:279*t*
 - carburization rate variations 1:280*f*
 - cathodic modification 3:2231
 - chromia (Cr₂O₃) scale growth mechanisms 1:419
 - chromium carbide precipitation 1:276*t*
 - compositions 1:609*t*
 - corrosion rates 3:2232*t*
 - external chromia scale formation 1:427, 1:429*f*
 - internal carbides 1:277*t*
 - internal oxidation 1:427, 1:428*f*
 - noble metal additions 3:2231, 3:2241
 - nonprotective oxidation 1:426
 - passive films 2:727, 3:2194–2195, 3:2195*t*
 - phase diagram 1:70*f*, 1:278*f*, 1:568*f*, 1:584, 1:585*f*
 - polarization curves 3:2235*f*
 - simulation techniques 2:1550*f*
 - steam and steam/hydrogen environments 1:444*f*
 - surface alloying processes 3:2240
- iron–chromium–molybdenum (Fe–Cr–Mo) alloys 3:2233, 3:2234*t*, 3:2241
- iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
- iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
- iron–nickel–cobalt (Fe–Ni–Co) alloys 1:551*f*
- iron–nickel (Fe–Ni) alloys 3:1789–1801
- acid corrosion 3:1792, 3:1792*t*
 - atmospheric corrosion 3:1790, 3:1791*f*, 3:1791*t*
 - carburization 1:296, 1:297
 - diffusion coefficients 1:307*t*
 - electrochemistry 3:1790, 3:1790*f*
 - fireside corrosion 1:472*f*
 - freshwater environments 3:1791
 - galvanic corrosion 3:1793, 3:1794*t*
 - general discussion 3:1790
 - industrial environments 3:1792
 - nitridation processes 1:307*t*
 - phase diagram 1:70*f*
 - salt solutions 3:1792
 - seawater corrosion 3:1791, 3:1791*t*, 3:1792*t*
 - stress corrosion cracking (SCC) 3:1793, 3:1793*t*
- iron–nickel–sulfur (Fe–Ni–S) alloys 1:244*f*, 1:245*f*
- iron–silicon (Fe–Si) alloys 4:2783
- metal dusting
- background information 1:285
 - cementite decomposition 1:286–287, 1:287*f*, 1:288*f*
 - cementite formation 1:285, 1:286*f*, 1:287*f*
 - coke filaments 1:286, 1:287*f*
 - coking rates 1:290*f*, 1:291*f*
 - ferritic chromium steels 1:291, 1:292*f*, 1:293*f*
 - gas composition effects 1:288, 1:290*f*
 - graphite–cementite interface 1:287, 1:289*f*
 - Hochman–Grabke model 1:286*f*
 - iron–aluminum (Fe–Al) alloys 1:292
 - iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
 - low-alloy steel 1:290, 1:290*f*, 1:291*f*
 - mass transport model 1:287*f*
 - non-cementite iron dusting conditions 1:288, 1:289*f*
 - temperature effects 1:288, 1:290*f*
- nickel–iron–chromium (Ni–Fe–Cr) alloys
- carbide precipitation zones 1:281*f*
 - carburization rate variations 1:280*f*
 - cast refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:603*t*
 - cathodic modification 3:2235
 - coke deposition 1:292*f*
 - galvanic corrosion 2:831*f*, 2:851*t*, 2:852*t*, 2:1119*f*
 - global rating parameter (KB₄) 1:594, 1:596*f*
 - high temperature oxidation behavior 1:552*f*, 1:593, 1:593*f*, 1:594*f*
 - intergranular corrosion 2:819
 - intragranular corrosion 2:1478
 - metal dusting 1:291, 1:292*f*, 1:293*f*
 - post-carburization appearance 1:282*f*
 - sulfidation corrosion 1:250
 - surface alloying processes 3:2240
 - wrought refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:599*t*, 1:600*t*
 - nitridation resistance 1:309*f*
 - quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 - silicon–molybdenum iron (Si–Mo Fe) alloys 4:2784
- iron aluminum beryllide (FeAlBe₄) 3:2173, 3:2173*f*
- iron beryllide (FeBe₃) 3:2173, 3:2173*f*
- iron carbide (Fe₃C)
- coke filaments 1:286, 1:287*f*
 - decomposition processes 1:286–287, 1:287*f*, 1:288*f*
 - formation processes 1:285, 1:286*f*
 - graphite–cementite interface 1:287, 1:289*f*
 - mass transport model 1:287*f*
 - properties 1:275*t*
- iron carbonate (FeCO₃) 2:965*f*, 2:1275*f*, 2:1276*f*, 2:1290*f*, 4:2942*t*
- iron–carbon (Fe–C) alloys
- equilibrium microstructures 3:1697, 3:1698*f*
 - mechanical properties 3:1699, 3:1699*t*
 - nonequilibrium microstructures 3:1697, 3:1698*f*
 - phase diagram 3:1695, 3:1696*f*
 - physical properties 3:1699, 3:1699*t*
- iron chloride (FeCl₂/FeCl₃) 1:27, 1:328*f*, 1:403*f*, 1:479*f*, 2:1209, 4:3314
- iron nitride (Fe₄N)
- internal nitridation processes 1:260
 - nitridation processes
 - diffusion-controlled internal nitridation 1:306
 - heat-resisting alloys 1:260
 - thermodynamic stability 1:308, 1:308*f*
- iron oxide (Fe₂O₃)
- amorphous alloys 3:2197*f*
 - diffusion processes 1:128
 - enamel frit compositions 3:2321*t*
 - fracture toughness values 1:168*t*
 - intermetallic alloys 1:652*f*
 - mineral compositions 4:2942*t*
 - oxidation processes 1:182*t*, 1:183*f*, 1:201, 1:201*f*, 1:202*f*
 - oxide basicity 1:477*f*
 - oxide nodule formation 1:176*f*
 - oxide solubility 1:476*f*
 - phase diagram 1:320*f*
 - Pilling–Bedworth ratio (PBR) 1:160*t*
 - point defects 1:128
 - Poisson ratios 1:170*t*
 - Portland cement 3:2349, 3:2350*t*
 - scale failure strain measurements 1:167*t*
 - solubility plot 1:320*f*
 - steam and steam/hydrogen environments
 - dissociation pressure 1:412*f*
 - equilibrium oxygen partial pressure 1:410*f*
 - material testing considerations 1:413*f*
 - molecular diffusion 1:417*f*
 - oxide scale growth 1:435*f*
 - void and gap formation 1:436*f*, 1:437*f*, 1:439*f*
 - stress growth measurements 1:159*t*, 1:175*f*
 - superheater deposit composition 1:464*t*
 - surface fracture energies 1:170*t*
- iron oxide (Fe₃O₄)
- diffusion processes 1:128
 - fracture toughness values 1:168*t*
 - intermetallic alloys 1:652*f*
 - oxidation processes 1:182*t*, 1:183*f*, 1:201, 1:201*f*, 1:202*f*
 - oxide nodule formation 1:176*f*

- phase diagram 1:320*f*
 Pilling–Bedworth ratio (PBR) 1:160*t*
 point defects 1:128
 Poisson ratios 1:170*t*
 potential–pH (Pourbaix) diagram 2:1084*f*
 scale failure strain measurements 1:167*t*
 steam and steam/hydrogen environments
 equilibrium oxygen partial pressure 1:410*f*
 molecular diffusion 1:417*f*
 oxide scale growth 1:434*f*, 1:435*f*
 void and gap formation 1:436*f*, 1:437*f*, 1:439*f*
 stress growth measurements 1:159*t*, 1:175*f*
 surface fracture energies 1:170*t*
- iron oxide (FeO)
 amorphous alloys 3:2197*f*
 corrosion-resistant coatings 4:2995*t*
 diffusion processes 1:128
 Ellingham diagram 1:652*f*
 equilibrium oxygen partial pressure 1:410*f*
 fracture toughness values 1:168*t*
 free energy 1:542*f*
 intermetallic alloys 1:652*f*
 oxidation processes 1:182*t*, 1:183*f*, 1:201, 1:201*f*, 1:202*f*
 Pilling–Bedworth ratio (PBR) 1:160*t*
 point defects 1:128
 Poisson ratios 1:170*t*
 scale failure strain measurements 1:167*t*
 surface fracture energies 1:170*t*
- iron-oxidizing bacteria 3:1775
- iron phosphate (FePO₄/Fe₃(PO₄)₂) 4:2495, 4:2497*t*, 4:2500*t*
- iron-related bacteria (IRBs) 4:2949
- iron sulfate (FeSO₄) 1:320*f*, 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
- iron sulfide (FeS)
 aqueous hydrogen sulfide (H₂S) corrosion 2:1288, 2:1289*f*, 2:1290*f*
 compositions 4:2938, 4:2942*t*
 flow-induced corrosion 2:965*f*
 sulfate-reducing bacteria (SRB) 2:1174, 2:1177*f*
- iron sulfide (FeS₂) 1:320*f*, 2:1288
- magnesium alloys 3:2019*t*
- magnetite (Fe₃O₄) 1:128
- metal dusting
 background information 1:285
 cementite decomposition 1:286–287, 1:287*f*, 1:288*f*
 cementite formation 1:285, 1:286*f*, 1:287*f*
 coke filaments 1:286, 1:287*f*
 coking rates 1:290*f*, 1:291*f*
 ferritic chromium steels 1:291, 1:292*f*, 1:293*f*
 gas composition effects 1:288, 1:290*f*
 graphite–cementite interface 1:287, 1:289*f*
 Hochman–Grabke model 1:286*f*
 iron–aluminum (Fe–Al) alloys 1:292
 iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
 low-alloy steel 1:290, 1:290*f*, 1:291*f*
 mass transport model 1:287*f*
 non-cementite iron dusting conditions 1:288, 1:289*f*
 temperature effects 1:288, 1:290*f*
- metallurgical properties 3:2169*t*
- nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
 alloy 20
 corrosion resistance 3:1891
 galvanic corrosion 2:831*f*, 2:1119*f*
 historical development 3:1882*t*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 maximum depth of crevice attack 2:1128*t*
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 31
 acetic acid production 3:1908
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 corrosion rates 3:1905*f*, 3:1911*f*
 corrosion resistance 3:1892, 3:1900
 fine and specialty chemicals 3:1910
- historical development 3:1882*t*
 hydrochloric acid (HCl) isocorrosion diagram 3:1894*f*
 major alloying elements 3:1881*t*
 phosphoric acid (H₃PO₄) production 3:1905, 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*, 3:1900, 3:1901*t*
 pollution controls 3:1912
 stability limits 3:1895*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237*f*, 3:1893*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 tank transport studies 3:1912
- alloy 33
 alkali corrosion 2:1200*f*
 caustic soda (NaOH) production 3:1902, 3:1902*f*
 corrosion loss measurements 3:1896*t*, 3:1897*t*
 corrosion resistance 3:1892, 3:1896*f*
 historical development 3:1882*t*
 major alloying elements 3:1881*t*
 pitting resistance 3:1894*f*, 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 825
 alkali corrosion 2:1200*f*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 hydrohalic acid corrosion 2:1217*f*, 2:1219*f*
 major alloying elements 3:1881*t*
 nuclear waste isolation 2:767
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*, 2:1243*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 vinyl chloride monomer (VCM) production 3:1908
- alloy G-3
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
- alloy G-30
 corrosion loss measurements 3:1896*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 major alloying elements 3:1881*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 laser surface alloying (LSA) 4:2631
 major alloying elements 3:1881, 3:1881*t*
- nitric acid (HNO₃) solutions 2:1252*t*
- oxidation processes
 characteristics 1:201
 high-temperature oxidation 1:182*t*, 1:183*f*, 1:202*f*
 oxide cross-section 1:202*f*
 resistance factors 1:560, 1:561*f*, 1:562*f*
 scale formation 1:182*t*, 1:183*f*
 stability conditions 1:201*f*
- physical properties 3:2054*t*
- pitting corrosion 2:774*t*
- potential–pH (Pourbaix) diagram 1:30–31, 1:31*f*, 2:1193*f*, 3:1702, 3:1703*f*, 3:1706*f*, 4:2894*f*
- redox couples equilibrium potential values 1:26*t*
- relative humidity threshold values 4:3314, 4:3315*f*, 4:3316*f*
- rust formation 4:2667
- scale formation 2:1102
- silicon–iron (Si–Fe) anodes 4:2813, 4:2814*t*
- sodium–iron–sulfur–oxygen (Na–Fe–S–O) phase diagram 1:320*f*
- soil corrosion 2:1159*f*
- standard reduction potential 3:2074*t*
- sulfuric acid–iron sulfate (H₂SO₄–FeSO₄) test (Streicher test) 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
- surgical implants 2:1310
- tetracalcium aluminoferrite (C₄AF) 3:2350*t*, 3:2351
- uniform corrosion 2:728

- iron (Fe) (*continued*)
 water corrosion 2:830*f*, 2:1098, 2:1098*t*
 wood corrosivity
 contact corrosion 2:1324
 general discussion 2:1324
 staining 3:2444, 3:2445
 wood degradation effects 2:1325, 3:2442, 3:2445
 wüstite (FeO) 1:128, 1:201
 zinc-cobalt-iron (Zn-Co-Fe) coatings 4:3188*t*
 zinc-iron (Zn-Fe) alloys 4:2558
 IR reflection absorption spectroscopy (IRRAS) 2:1376*t*, 2:1403
 isocyanate-based polymers 4:2652
 isothiazolines 4:2968–2969
- J**
- Japanese Oscar WWII fighter jet 4:3323, 4:3323*f*
 Jarosite process 3:1862
 Jeffrey's Alite (C₅₄S₁₆AM) 3:2351
 \mathcal{J} -integral 1:84, 1:85*f*
 joint generalized extreme value (JGEV) multivariate density function 2:1554
 joints/joining processes 3:2447–2462
 aluminum alloys 3:2461
 basic concepts 3:2447
 carbon steel 3:2456, 3:2457*f*
 insulated joints 3:2450*f*
 low-alloy steel 3:2456, 3:2457*f*
 mechanical fasteners 3:2449, 3:2450*f*, 3:2452*t*
 nickel alloys 3:2461
 protective treatments 3:2461
 soldering and brazing methods
 brazed joints 3:2451
 filler materials 3:2450, 3:2451*t*
 fluxes 3:2451*t*
 general discussion 3:2450
 joining processes 3:2452*t*
 soldered joints 3:2450
 traditional alloys 3:2451*t*
 stainless steels
 austenitic stainless steels 3:2458, 3:2459*f*
 common corrosion sites 3:2458*f*
 duplex stainless steels 3:2459
 ferritic stainless steels 3:2458, 3:2459*f*
 general discussion 3:2458
 localized corrosion 3:2460
 martensitic stainless steels 3:2458
 sensitization conditions 3:2460, 3:2460*f*
 welded joints
 fusion welding 3:2452*t*, 3:2453*f*
 resistance welding 3:2452*t*, 3:2453*f*
 solid-phase welding 3:2452*t*
 weldability factors 3:2453*t*
 weld defects 3:2453, 3:2453*f*, 3:2454*f*, 3:2454*t*
 welding processes 3:2452, 3:2452*t*, 3:2453*f*
 weldment corrosion factors
 filler metal composition 3:2455
 general discussion 3:2453
 postweld heat treatment (PWHT) 3:2455
 residual stresses 3:2455, 3:2455*f*
 welding technique 3:2454
 weld joint design 3:2453, 3:2455*f*
 \mathcal{J} R-curve 1:86, 1:86*f*
- K**
- kainite 3:2013*t*
 kaolinite 2:1154
 ketones 4:2490, 4:2992*t*
 key performance indicators (KPIs) *see* risk-based inspection (RBI)
 kieserite 3:2013*t*
 Kirkendall effect 1:118, 1:118*f*, 1:651–653
 kitchenware 3:1860, 3:1861*t*
 knife line attacks
 austenitic stainless steels 2:818
 Kramers–Kronig (K–K) transform 2:1358
 Kröger–Vink notation 1:110, 1:111*f*, 1:111*t*, 1:416, 2:1642–1643
 K_r parameter
 basic concepts 4:3107
 example calculation 4:3108
 limiting conditions 4:3108*f*
 krypton (Kr) 2:1053*t*
- L**
- lactic acid 3:1766, 3:1842, 3:2130, 4:2882
 ladders/laddering 4:2733
 laminated tapes 4:2707
 laminated woods *see* wood
 lamination 4:2739
 Langelier saturation index (LSI) 2:1100, 3:1753, 4:2958
 Langmuir isotherm 1:27–28, 2:1604–1605
 lanthanum (La)
 alumina-forming alloys 1:608*t*, 1:609*t*, 1:628
 chromia-forming alloys 1:608*t*, 1:609*t*
 chromium-lanthanum (Cr-La) alloys 1:589
 cobalt-based alloys 3:1918*t*
 ferritic chromium steels 1:501*t*, 1:507, 1:508*f*
 magnesium alloys 3:2014–2015
 thermal expansion coefficients 1:484*t*
 Larson–Skold index (L–SI) 4:2960
 lasers
 corrosion fatigue prevention strategies 2:950
 excimer laser 4:2623
 high-power diode laser (HPDL) 4:2623
 laser–material interactions 4:2622–2635
 basic concepts 4:2623
 laser-applied coatings
 advantages 4:2633
 general discussion 4:2624
 high-velocity oxy-fuel (HVOF)/high-velocity air fuel (HVAF) spraying 4:2626
 laser chemical vapor deposition (LCVD) 4:2629, 4:2629*f*, 4:2630*f*, 4:2633*t*
 laser cladding (LC) 4:2624, 4:2625*f*, 4:2633*t*
 laser gas nitriding (LGS) 4:2632, 4:2632*f*, 4:2633*t*
 laser-hybrid sprayed coating techniques 4:2617, 4:2627, 4:2633*t*
 laser melt/particle injection (LMI) 4:2628
 laser surface alloying (LSA) 4:2630, 4:2632*f*, 4:2633*t*
 laser surface melting/remelting (LSM) 4:2626, 4:2633*t*
 limitations 4:2633
 magnesium alloys 3:2036
 metal matrix composite (MMC) coatings 4:2626–2627
 pulsed laser deposition (PLD) 4:2628, 4:2628*f*, 4:2633*t*
 solidification microstructures 4:2623
 Nd:YAG (neodymium-doped yttrium aluminum garnet) laser 3:2024, 4:2623
 latent heat 4:2932
 latex gloves 3:2428, 3:2430*f*, 3:2430*t*
 lead (Pb) 3:2053–2067
 alloys
 characteristics 3:2055
 compositions 3:2055*t*
 impressed current anodes 4:2786, 4:2787*t*, 4:2814*t*, 4:2815
 lead-antimony (Pb-Sb) alloys 1:65*f*, 1:66*f*, 3:2055, 3:2055*t*
 lead-calcium (Pb-Ca) alloys 3:2055, 3:2055*t*
 lead-copper (Pb-Cu) alloys 3:2055, 3:2055*t*
 lead-silver (Pb-Ag) alloys 3:2055, 3:2055*t*, 4:2814*t*, 4:2815
 lead-tellurium (Pb-Te) alloys 3:2055, 3:2055*t*
 lead-tin (Pb-Sn) alloys 3:2055, 3:2055*t*
 process equipment materials 4:3211
 sulfuric acid (H₂SO₄) environments 2:1244, 2:1245*f*
 archaeological metals 2:1159, 4:3311*f*
 atmospheric corrosion 2:848*f*
 cathodic protection 4:2755, 4:2755*t*
 chemically resistant membranes 3:2343
 coating characteristics 4:2525
 corrosion removal methods 4:3322
 corrosion-resistant coatings 4:2995, 4:2995*t*

- corrosive environments 1:92, 1:405
- corrosivity
- acid corrosion
 - mineral acids 3:2063
 - organic acids 3:2063
 - alkali corrosion 3:2064
 - atmospheric corrosion 3:2060
 - buried structures
 - stray-current corrosion 3:2062
 - underground corrosion 3:2062
 - halide-containing environments 3:2064
 - lubrication oils 3:2064
 - sulfuric acid (H₂SO₄) environments 4:3058f
 - water (H₂O)
 - condensed water 3:2061
 - distilled water 3:2061
 - natural waters 3:2061
- crystal structure 1:55r
- electrochemistry
- anodic behavior 3:2058
 - corrosion products 3:2059
 - dissolution thermodynamics 3:2058
 - galvanic corrosion 3:2060
 - lead sulfate (PbSO₄) system 3:2057–2058, 3:2058f
 - lead–water (Pb–H₂O) system 3:2057, 3:2057f
 - oxidation 3:2058
 - passivation 3:2059
 - potential–pH (Pourbaix) diagram 3:2057f
 - solubility 3:2060r
 - thermodynamics 3:2057
- exchange current density 3:2217r
- fuel chemistry 1:459, 1:459r
- galvanic corrosion 2:831f, 2:850r, 2:851r, 2:852r, 2:1119f
- galvanizing zinc melts 4:2570
- historical background 3:2053
- hot tinning 4:2571
- industrial applications
- general discussion 3:2054
 - lead–acid batteries 3:2065
 - lead anodes 3:2064
 - lead-based alloys 3:2055r
 - reactor coolants 3:2066
- lead carbonate (PbCO₃) 3:2060r, 4:2670
- lead chloride (PbCl₂) 1:403f, 1:465f, 3:2060r
- lead dioxide (PbO₂) 3:2060r, 3:2197f, 4:2788
- lead hydroxide (Pb(OH)₂) 3:2060r
- lead–magnetite (Pb–Fe₃O₄) composites 4:2788
- lead nitrate (Pb(NO₃)₂) 3:2060r
- lead oxide (PbO) 3:2060r, 3:2197f, 3:2308r
- lead phosphate (Pb₃(PO₄)₂) 3:2060r
- lead–platinum (Pb–Pt) bielectrodes 4:2787
- lead sulfate (PbSO₄) 3:2057–2058, 3:2058f, 3:2060r, 4:2670
- lead sulfide (PbS) 3:2060r
- mechanical properties
- lead alloys 3:2056, 3:2056r
 - lead (Pb) 3:2056, 3:2056r
- pH factors 2:1105
- physical properties 3:2054, 3:2054r
- pigments 4:2670
- production processes 3:2053
- soil corrosion 2:1158, 2:1159f, 3:2062
- solders 3:2075
- standard reduction potential 3:2074r
- water chemistry 2:1098r
- wood corrosivity 2:1326
- Legionella* spp. 2:1188
- Legionella* spp. 4:2951, 4:2951f
- Leonard–Kemira process 3:2125–2126
- lepidocrocite (Fe₂O₃·H₂O) 4:2942r
- leukoplakia 2:1311
- lichen planus 2:1311
- lighting and signage posts 4:3205
- light water reactors (LWRs) 2:1333, 2:1333f
- lignin 2:1323, 2:1325
- see also wood
- lignite 1:459r
- Limnoria* spp. 3:2442, 3:2445–2445
- linear-energy transfer (LET) value 2:1330, 2:1332r
- linear polarization resistance measurements (LPRMs)
- basic concepts 2:1355
 - coupon testing 2:1562, 2:1563f
 - data analysis 2:1358
 - error analysis 2:1358
 - instrumentation configurations 2:1357f
 - noise levels 2:1357f
- linear polyesters 3:2383
- linear rate law 1:136, 1:136f, 1:187
- linear regression statistical method 2:1553
- line pipe coatings
- coal tar and asphalt/bitumen enamels 4:2709, 4:2812r, 4:3283, 4:3283r
 - FBE powder coatings 4:2708f, 4:2709, 4:2812r, 4:2836f, 4:3283, 4:3283r
 - general discussion 4:2707
 - line pipe coating plant schematic diagram 4:2708f
 - polyolefin coatings 4:2708f, 4:2710, 4:2812r, 4:3283, 4:3283r
- linseed oil 4:2668r, 4:2670
- linseed penta-alkyd 4:2668r
- liquid-applied coatings (paint) 4:2705, 4:2706f, 4:3283, 4:3283r
- liquid-applied field joint coatings 4:2711, 4:2712f
- liquid feedstock 4:2617
- liquid metal embrittlement (LME)
- aluminum alloys 3:1995, 3:1995f
 - corrosive environments 1:405
- liquid phase sintered silicon carbides 3:2299
- lithium (Li)
- aluminum–lithium (Al–Li) alloys 2:930f, 3:1981
 - glass ceramics 3:2297
 - intermetallic alloys 1:662
 - lithium-containing alloys 3:1981
 - lithium oxide (Li₂O) 3:2308r, 3:2321r, 3:2331r
 - magnesium alloys 3:2015, 3:2016r, 3:2019r
- liver research 2:1310r
- loam 2:1155f, 3:2087r, 4:2563r
- localized corrosion
- aqueous carbon dioxide (CO₂) corrosion 2:1286
 - characteristics 1:95r, 2:1633
 - corrosion management 4:3010
 - corrosion risk mitigation 4:3056
 - marine environments 2:1125, 2:1127r
 - metal–matrix composites 3:2259, 3:2259f, 3:2261f, 3:2262f
- passivity
- alloys 2:744
 - anodic polarization curves 2:732f, 2:733f, 2:734f, 2:735, 2:735f
 - basic concepts
 - anodic polarization curves 2:732f, 2:733f, 2:734f
 - general discussion 2:731
 - chemical/electrochemical passivity 2:733f, 2:734f, 2:743
 - corrosion rate determination 2:734
 - film compositions 2:746
 - kinetic mechanisms 2:737
 - nonaqueous liquids 2:744
 - oxide film growth mechanisms 2:737
 - passivity breakdown 2:735f, 2:747, 2:1621, 3:1824
 - thermodynamics
 - basic concepts 2:740
 - potential–pH (Pourbaix) diagram 2:742f
- pipeline corrosion management
- flow-induced localized corrosion (FILC) 4:3293
 - general discussion 4:3293
 - mesa corrosion 4:2902f, 4:3293
 - pitting corrosion 4:2902f, 4:3293
 - preferential weld corrosion 4:3293
- stainless steels 3:1824
- surgical implants 2:763
- zirconium/zirconium alloys 3:2106
- logarithmic rate law 1:137, 1:187
- long-line corrosion 2:1156
- long-range ultrasonic transmission (LRUT) system 4:3152–3153, 4:3153f
- long-term drying shrinkage 3:2358, 3:2358f
- low-alloy steel 3:1693–1736
- above-water fastener selection 2:847f
 - acetic acid–sodium chloride mixtures 4:3059r
 - adhesive bond failure 3:2473, 3:2473f, 3:2475f, 3:2476f, 3:2477f
 - alloying element influences 3:1724f
 - ammonia damage 4:3220r

- low-alloy steel (*continued*)
 ammonium nitrate 4:2883
 aqueous corrosion
 crevice corrosion 3:1711
 differential aeration cell corrosion 3:1710, 3:1710f
 erosion-corrosion 3:1712
 flow-assisted corrosion 3:1712
 galvanic corrosion 3:1711
 general corrosion 3:1710
 pitting corrosion 3:1711
 protective treatments 3:1713
 solubility products 3:1712t
 tuberculation corrosion 3:1710f
 atmospheric corrosion
 acid regeneration cycle 3:1718
 air-borne pollutants 3:1715, 3:1715t, 3:1716f
 alloying effects 3:1720f, 3:1722f, 3:1723, 3:1724f
 atmospheric corrosivity classifications 3:1725, 3:1726t, 3:1727t
 climatic variation 3:1720, 3:1721t
 corrosion kinetics 3:1720
 corrosion mechanisms 3:1718
 corrosion product composition 3:1719
 corrosion rates 3:1722, 3:1722f, 3:1723t
 electrochemical mechanisms 3:1719
 environmental influences 3:1714
 exposure conditions 3:1721
 next generation weathering steels 3:1725, 3:1725t
 particulate matter 3:1715f, 3:1717, 3:1718t
 relative humidity (RH) 3:1714, 3:1715f, 3:1715t
 sea salt 3:1718t
 urban/rural/marine atmospheres 2:848f
 weathering steels 3:1723, 3:1724
 wet/dry cycles 3:1719, 3:1720f, 3:1723, 3:1725f
 below-water fastener selection 2:849f
 brazed joints 3:2451
 carbon dioxide (CO₂) environments 2:855f
 cathodic protection criteria 4:2847t
 chlorine-related corrosion 1:479f
 corrosion fatigue 2:944
 corrosion processes
 aqueous corrosion 3:1710
 corrosion products 3:1709t
 environmentally-assisted cracking 3:1712
 general discussion 3:1709
 high-temperature oxidation 3:1713
 hydrogen embrittlement 3:1713
 microbially-induced corrosion (MIC) 3:1713
 corrosion rates 2:1114f, 4:2876, 4:2878f
 corrosion testing 2:1475, 2:1476f, 2:1477f
 electrochemical effects 2:1088
 electrochemistry
 anodic dissolution 3:1704
 aqueous corrosive environments 3:1708
 cathodic reactions 3:1707
 passivity 3:1705
 potential-pH (Pourbaix) diagram 3:1702, 3:1703f, 3:1706f
 thermodynamics 3:1702
 environmentally-assisted cracking 4:3217f, 4:3218f
 erosion resistance 2:985f
 galvanic corrosion 2:1011, 2:1013f
 high-temperature oxidation 1:466f
 historical background 3:1695
 hydrogen sulfide (H₂S) damage 4:3219f
 hydrogen sulfide (H₂S) environments 2:855f
 iron-carbon (Fe-C) alloys
 equilibrium microstructures 3:1697, 3:1698f
 mechanical properties 3:1699, 3:1699t
 nonequilibrium microstructures 3:1697, 3:1698f
 phase diagram 3:1695, 3:1696f
 physical properties 3:1699, 3:1699t
 marine corrosion
 alloying element influences 3:1702f, 3:1702t
 corrosion profile 2:1121f
 corrosion rates 2:1114f, 2:1120, 2:1121t
 design-based mitigation 4:3080f
 exposure rate-dissolved oxygen plot 2:1124f
 exposure rate-seawater depth plot 2:1124f
 hydrogen embrittlement 2:1123-1124
 mass loss 2:1122f
 pitting corrosion 2:1122-1123, 2:1122f, 2:1123f
 polarization curves 2:1114f, 2:1120f
 protective treatments 2:1143
 seawater velocity effects 2:1122f
 materials selection 4:3210, 4:3210f
 metal dusting 1:290, 1:290f, 1:291f
 microbially-induced corrosion (MIC) 2:1176, 2:1177f
 molybdenum additives 3:2159
 oxidation resistance 1:558-582
 alloying effects
 aluminum (Al) 1:566
 basic concepts 1:562, 1:563f, 1:564f
 carbon (C) 1:565
 cerium (Ce) 1:569
 chromium (Cr) 1:568, 1:568f
 copper (Cu) 1:569
 diffusion-controlled growth 1:564f
 manganese (Mn) 1:567
 molybdenum (Mo) 1:569
 nickel (Ni) 1:568
 phosphorus (P) 1:568
 silicon (Si) 1:566
 sulfur (S) 1:567
 commercial low-alloy steels 1:572, 1:573f
 general discussion 1:558
 governing factors 1:559, 1:560f
 industrial environments
 carbon monoxide/carbon dioxide (CO/CO₂) environments 1:578, 1:579f
 chemical environments 1:577
 combustion gas conditions 1:576
 steam environments 1:573, 1:575f, 1:576f
 iron oxidation 1:560, 1:561f, 1:562f
 stress effects
 general discussion 1:570
 growth stresses 1:571, 1:571f
 system-applied stresses 1:572
 thermal stresses 1:572
 passivation current density 4:2876f, 4:2877f
 passive range 4:2877f
 phosphoric acid (H₃PO₄) 4:2881
 potentiodynamic curves 4:2876f
 processing techniques
 alloying element influences 3:1702f, 3:1702t
 corrosion rates 3:1700, 3:1701t, 3:1702t
 marine corrosion resistance 3:1702t
 mechanical deformation 3:1700, 3:1701f
 protective barrier inducement (PBI) 4:2898f, 4:2899f
 reducing environments 1:468f
 scale inhibitors/dispersants 4:2993t
 S-N (stress-number of cycles to failure) curves 2:930f
 soil corrosion 2:1152f, 2:1157, 2:1157f, 2:1158f
 storage tanks
 alkaline environments 4:2888
 cellulose boilers 4:2888
 liquid fertilizer storage tanks 4:2888
 sulfuric acid (H₂SO₄) 4:2887
 stress corrosion cracking (SCC) 2:867t, 2:871f, 4:3058f
 sulfidation corrosion 1:241f, 1:246f
 sulfuric acid (H₂SO₄) environments 2:1236f, 2:1238f, 4:3058f
 sweet corrosion 4:3291
 underground corrosion
 buried steel 3:1732
 controlling factors 3:1731, 3:1732t
 long-term burial 3:1733
 pilings 3:1732
 pipelines 3:1733
 water corrosion
 accelerated low water corrosion (ALWC) 3:1729
 boiler waters 3:1731
 deposits and scales 3:1728
 dissolved gases 3:1726
 dissolved solids 3:1727
 fouling deposits 3:1728
 heating and cooling systems 3:1730, 3:1731t

- height-related corrosion 3:1730, 3:1731f
 microbial effects 3:1728
 natural waters 3:1728, 3:1729t
 piped fresh water systems 3:1729, 3:1730t
 process waters 3:1730
 under-deposit corrosion 3:1728
 unprotected structural steel 3:1729
 water composition 3:1726
 wear effects 1:393f
 welding processes 3:2456, 3:2457f
 low-pressure plasma spraying (LPPS) 4:2615
 low-pressure steam turbine (LPST) modeling study
 blade failure probabilities 2:1674t, 2:1675f
 disc failure probabilities 2:1674f, 2:1674t, 2:1675f
 general discussion 2:1673
 low solar absorption (LSA) coatings 4:2699
 low-temperature multieffect desalination plants (LT-MED) 3:1865
L_v, parameter
 basic concepts 4:3106
 example calculation 4:3107
 limiting conditions 4:3106f
 lubricant systems 2:1299–1307
 additives
 additive types 2:1302, 2:1303t
 extreme pressure/antiwear additives 2:1302, 2:1303t
 in greases 2:1303
 interaction concerns 2:1303
 sulfur-containing additives 2:1303
 cavitation 2:1305
 corrosive wear 2:1304
 deterioration processes
 biodeterioration 2:1302
 combustion products 2:1301
 oxidative degradation 2:1301
 erosion 2:1305
 gear lubricants 2:1305
 health and safety concerns 2:1307
 internal combustion engine lubricants 2:1304
 lubricants
 general discussion 2:1300
 greases 2:1301, 2:1303
 oil-based lubricants 2:1300
 metal-working lubricants 2:1305
 oil condition monitoring 2:1306
 specially-formulated lubricants 2:1306
 steam-turbine lubricants 2:1305
 testing methods 2:1306
 water-based lubricants 2:1306
 zinc coatings 4:2563
 Luggin–Haber capillary 2:845
 lung research 2:1310t
Lyctus spp. 3:2445
 lymphatic system research 2:1310t
- M**
- mackinawite 2:1288, 2:1288t, 2:1289f
 maghemite (Fe₂O₃) 4:3311
 magnesite 3:2013t
 magnesium (Mg)
 aluminum alloys 2:867t, 3:1980
 atmospheric corrosion 2:848f
 cordierite (Al₃Mg₂(Si₅AlO₁₈)) 1:674
 crystal structure 1:55t
 fuel chemistry 1:459, 1:459t
 galvanic corrosion 2:831f, 2:850t, 2:851t, 2:852t, 2:1119f, 3:1845f
 glass ceramics 3:2297
 magnesium alloys 3:2011–2041
 aircraft corrosion
 airframe corrosion 4:3178t
 corrosion behavior 4:3183
 design guidelines 4:3191t
 protective treatments 4:3184t, 4:3188, 4:3189f
 reprotective treatments 4:3194t
 applications
 automotive industry 3:2037, 3:2038f
 communication industry 3:2038f
 current applications 3:2014f
 potential applications 3:2011
 biomedical devices 2:1315
 characteristics
 alloy compositions 3:2018t
 alloy designation systems 3:2015, 3:2019t
 alloying elements 3:2013, 3:2016t, 3:2019f
 binary alloy systems 3:2015t
 cast magnesium alloys 3:2017, 3:2020t, 3:2021t, 3:2023f
 electrolyte composition 3:2014t
 extraction processes 3:2013
 metallurgical properties 3:2013
 metal matrix composites (MMCs) 3:2020
 physical properties 3:2014t, 3:2017t
 raw material sources 3:2013t
 temper designations 3:2020t
 wrought magnesium alloys 3:2019, 3:2021t, 3:2022t, 3:2024f
 coatings
 anodic films 3:2034, 3:2035f, 3:2035t, 3:2036f
 chemical vapor deposition (CVD) 3:2036
 chromate conversion coatings (CCC) 3:2033
 coating systems and design 3:2037
 corrosion prevention strategies 3:2033
 electrochemical conversion coatings 3:2034, 3:2035f, 3:2035t, 3:2036f
 electro/electroless deposition 3:2034, 3:2036f
 electron beam deposition techniques 3:2036
 laser-applied coatings 3:2036
 organic coatings 3:2036
 thermal spraying 3:2036
 corrosion prevention strategies
 coatings 3:2033
 coating systems and design 3:2037
 corrosivity
 alloying process/impurities influences 3:2031, 3:2032f
 corrosion mechanisms 3:2026
 corrosion potential 3:2027f
 corrosion rates 3:2025f, 3:2032f
 electromotive force series (EMF series) 3:2026f
 environmentally-assisted cracking 3:2028
 general discussion 3:2025
 potential–pH (Pourbaix) diagram 3:2027f
 surface condition changes 3:2028f
 current applications 3:2014f
 environmentally-assisted cracking
 continuous crack propagation 3:2030f
 fracture surface appearance 3:2030f, 3:2031f
 friction stir weldment (FSW) 3:2031f
 open circuit potential (OCM) 3:2032f
 processing condition effects 3:2031f
 slow strain rate tensile (SSRT) tests 3:2029f, 3:2030f, 3:2031f
 stress corrosion cracking (SCC) 3:2030t, 3:2028
 stress–strain plots 3:2029f, 3:2031f, 3:2032f
 susceptibility 3:2030t
 transgranular cracking model 3:2030f
 galvanic corrosion 2:851t, 2:852t
 global production trends 3:2012f
 historical development 3:2012
 laser cladding (LC) 4:2624, 4:2633t
 magnesium–tin (Mg–Sn) alloys 1:67f
 pitting corrosion potential 2:782f
 potential applications 3:2011
 processing techniques
 casting technologies 3:2021, 3:2023f
 joining technologies 3:2023, 3:2025f
 metal forming processes 3:2022, 3:2024f
 welding 3:2023, 3:2025f
 sacrificial anodes 4:2769, 4:2769t, 4:2773
 scanning electron microscopy (SEM) analysis 2:1411f
 magnesium chloride (MgCl₂) 3:2119t, 4:2938–2939
 magnesium fluoride (MgF₂) 3:2301
 magnesium hydroxide (Mg(OH)₂) 2:1102, 3:2013t, 4:2942t
 magnesium oxide (MgO)
 amorphous alloys 3:2197f
 corrosion resistance 3:2290t
 enamel frit compositions 3:2321t
 glass compositions 3:2308t

- magnesium (Mg) (*continued*)
 Pilling–Bedworth ratio (PBR) 1:146*t*, 1:160*t*
 slag–magnesium oxide (MgO) contact 1:687*t*, 1:687*t*
 steel–magnesium oxide–carbon (MgO–C) contact 1:688
 steel–magnesium oxide (MgO) contact 1:687*t*, 1:687*t*
 superheater deposit composition 1:464*t*
 magnesium phosphate ($3\text{Mg}_3(\text{PO}_4)_2 \cdot \text{Mg}(\text{OH})_2$) 4:2942*t*
 magnesium silicate ($3\text{MgO} \cdot 2\text{SiO}_2 \cdot 2\text{H}_2\text{O}$) 2:1102, 4:2942*t*
 magnesium–silicon-containing alloys 3:1981
 magnesium sulfate (MgSO_4) 1:477*f*; 4:2938–2939, 4:2942*t*
 marine environments 2:1115–1116, 2:1117*f*, 2:1142
 metallurgical properties 3:2169*t*
 nitric acid (HNO_3) solutions 2:1252*t*
 physical properties 3:2017*t*
 rain chemistry 2:1064*t*
 reactive metal pigments 4:2653
 scale formation 2:1102
 seawater constituents 2:1109*t*
 standard reduction potential 3:2074*t*
 magnetite (Fe_3O_4) 1:128, 4:2487, 4:2784, 4:2788, 4:2938, 4:2942*t*, 4:3311
 makeup water treatment 4:2973
 Malaysian Rubber Producers Research Association (MRPRA) 3:2437
 maleic acid (MA) 4:2966
 maleic anhydride (MA) 4:2966
 malic acid 3:2073
 malleable cast iron 3:1740, 3:1751*t*, 3:1752*t*
 manganese (Mn)
 aircraft corrosion 4:3188*t*
 alloys
 alumina-forming alloys 1:608*t*, 1:609*t*
 aluminum alloys 3:1979
 chromia-forming alloys 1:424*f*, 1:425*f*, 1:426*f*, 1:608*t*, 1:609*t*
 chromium-containing alloys 1:584*t*, 1:589
 compositions 1:246*t*
 ferritic chromium steels 1:501*t*
 iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
 low-alloy steels 1:567
 magnesium alloys 3:2015, 3:2016*t*, 3:2019*t*
 manganese bronze 2:831*f*, 2:849*f*, 2:982*f*, 2:1119*f*
 sacrificial anodes 4:2769, 4:2773
 stainless steels 3:1810
 crystal structure 1:55*t*
 galvanizing zinc melts 4:2570
 high-temperature oxidation 1:182*t*, 1:183*f*
 manganese chloride ($\text{MnCl}_2 \cdot \text{H}_2\text{O}$)_{*n*} 3:1769*t*
 manganese dioxide (MnO_2) 3:2197*f*, 3:2321*t*
 manganese oxide (MnO) 1:160*t*, 1:168*t*, 1:170*t*, 3:2197*f*, 3:2331*t*
 manganese phosphate ($\text{Mn}_3(\text{PO}_4)_2$) 4:2495, 4:2496*f*, 4:2497*t*, 4:2500*t*
 manganese/silicon (Mn/Si) oxide 1:413*f*
 manganese sulfate (MnSO_4) 1:477*f*
 nitric acid (HNO_3) solutions 2:1252*t*
 reactive metal pigments 4:2653
 scale formation 2:1102
 stainless steels 3:1810
 water chemistry 2:1098, 2:1098*t*
 manual cleaning 4:2491
 maraging steels
 applications 3:1800
 compositions 3:1793, 3:1795*t*
 corrosion rates
 acid corrosion 3:1795
 atmospheric corrosion 3:1795, 3:1797*f*
 industrial environments 3:1795
 natural environments 3:1795
 seawater corrosion 3:1795, 3:1797*f*
 fabrication processes 3:1794
 mechanical properties 3:1794, 3:1796*t*
 physical properties 3:1795*t*
 stress corrosion cracking (SCC)
 cracking resistance 3:1798, 3:1798*f*
 crack propagation rates 3:1799*t*
 critical stress intensity factor (K_{ISCC}) 3:1798, 3:1799*f*
 high-temperature corrosion 3:1800, 3:1800*f*
 mechanisms 3:1796
 metallurgical variables 3:1799, 3:1799*t*
 testing methods 3:1797
 structural characteristics 3:1794
 Marangoni convection (submerged entry nozzle (SEN)) 1:682, 1:682*f*
 marine coatings 4:2683–2701
 coating processes
 maintenance and repair 4:2690
 Newbuilding shipyard 4:2689
 coating selection criteria
 ballast tanks 4:2692, 4:2693*f*, 4:2694*t*
 cargo holds 4:2696, 4:2697*f*, 4:2697*t*
 cargo tanks 4:2694
 chemical and product tankers 4:2695
 coating types and schemes 4:2695*t*
 external decks 4:2698, 4:2698*t*
 general discussion 4:2698
 topsides and superstructures 4:2699, 4:2699*t*
 underwater hulls 4:2691, 4:2692*t*
 vessel interiors 4:2699
 corrosion breakdown
 abrasive blasting standards 4:2687*t*
 ballast tanks 4:2692, 4:2693*f*, 4:2694*t*
 blistering 4:2685–2686
 cargo holds 4:2696, 4:2697*f*, 4:2697*t*
 cargo tanks 4:2694
 cathodic disbonding 4:2685–2686
 chemical and product tankers 4:2695
 cracking 4:2686*f*, 4:2686
 edge coatings 4:2688*f*, 4:2688
 general discussion 4:2685
 rust jacking 4:2686*f*, 4:2685–2686
 surface preparation 4:2687–2688
 underwater hulls 4:2692
 future trends 4:2699
 marine vessels
 ballast tanks
 coating selection criteria 4:2692
 coating types and schemes 4:2694*t*
 interior photograph 4:2693*f*
 schematic diagram 4:2684*f*
 square meters of steel 4:2684*t*
 general discussion 4:2683
 ship characteristics 4:2684*f*
 ship types 4:2684*t*
 square meters of steel 4:2684*t*
 performance characteristics 4:2685
 wood 3:2442
 marine environments 2:1107–1148
 aluminum alloys
 corrosion rates 2:1139*t*
 corrosion resistance 2:1138
 maximum depth of attack 2:1140*t*
 pit depth measurements 2:1140*f*
 wrought aluminum alloy designations 2:1139*t*
 carbon steel
 corrosion protection methods 2:1143
 corrosion rates
 alloying element influences 3:1702*f*, 3:1702*t*
 corrosion products 2:1114*f*
 corrosion profile 2:1121*f*
 design-based mitigation 4:3080*f*
 exposure rate–dissolved oxygen plot 2:1124*f*
 exposure rate–seawater depth plot 2:1124*f*
 general discussion 2:1120
 hydrogen embrittlement 2:1123–1124
 macrofouling 2:1114*f*
 mass loss 2:1122*f*
 pitting corrosion 2:1122–1123, 2:1122*f*, 2:1123*f*
 polarization curves 2:1114*f*, 2:1120*f*
 seasonal variations 2:1121*t*
 seawater velocity effects 2:1122*f*
 cast iron
 corrosion rates 2:1125*t*, 3:1759*t*, 3:1760*f*, 3:1760*t*, 3:1761*f*, 3:1762*t*, 3:1761*f*
 flow-induced corrosion 3:1778, 3:1779*f*, 3:1780*f*, 3:1780*t*
 general discussion 2:1125, 3:1758
 gray cast iron corrosion rates 3:1759*t*
 sodium chloride (NaCl) concentration effects 3:1758*f*
 copper alloys
 corrosivity 2:1131, 3:1952*t*, 3:1958

- critical design velocities 2:1132r
dealloying 2:1135
dissolved oxygen–corrosion rate plot 2:1134f
galvanic corrosion 2:1134–1135
impingement attacks 2:1134
macrofouling 2:1133
metal-ion concentration cell corrosion 2:1135
pitting corrosion 2:1133–1134
self-corrosion 2:1135
shear stresses 2:1132r
stress corrosion cracking (SCC) 2:1135
sulfate-reducing bacteria (SRB) 2:1132–1133
temperature–corrosion rate plot 2:1133f
corrosion management 4:3162
corrosion protection methods 2:1143
corrosion rates
 antifouling coatings 2:1143
 basic concepts 2:1113
 calcareous deposits 2:1115, 2:1115f, 2:1116f, 2:1117f, 2:1117t, 2:1143
 calcium/magnesium (Ca/Mg) ratio 2:1115–1116, 2:1117f
 cathodic protection 2:1115, 2:1117f, 2:1117t, 2:1143
 chloride ion sources 2:1113
 contaminant saturation conditions 4:2956
 corrosion product formation 2:1113, 2:1114f
 crevice corrosion 2:1116, 2:1118f
 current density 2:1115f, 2:1117f, 2:1117t
 galvanic corrosion 2:1118, 2:1119f, 2:1120f
 macrofouling 2:1113, 2:1114f, 3:2458
 oxidation reduction reaction 2:1113
 passive films 2:1116, 2:1118f
 polarization curves 2:1113, 2:1114f, 2:1120f
 sulfate-reducing bacteria (SRB) 2:1114–1115
environment characteristics
 calcareous deposits 2:1111, 2:1115, 2:1115f, 2:1116f, 2:1117f, 2:1117t, 4:2759
 depth effects 2:1111, 2:1112f, 2:1113f
 dissolved oxygen 2:1110, 2:1110f
 electrolytic resistivity 2:1113, 2:1113r
 general discussion 2:1108
 macro/microfouling 2:1111, 2:1113, 2:1114f, 3:2458
 pH 2:1110
 seawater constituents
 ionic concentrations 2:1109r
 salinity 2:1108, 2:1109t, 2:1110f
 temperature effects 2:1111
 velocity factors 2:1111
fiber reinforced plastics (FRPs) 3:2404
general discussion 2:1108
iron–nickel (Fe–Ni) alloys 3:1791r
lead corrosivity 3:2060
magnesium (Mg) 2:1142
marine aerosols 2:1059, 2:1061, 2:1067
metal–matrix composites 3:2265, 3:2265f
nickel-based alloys 2:1135, 2:1136r
nonmetallic materials 2:1142
protective coatings 2:1115, 2:1115f, 2:1116f, 2:1117f, 2:1117t, 4:2759
stainless steel corrosion
 crevice corrosion 2:1125, 2:1126f, 2:1127f, 3:1857r
 critical crevice corrosion solution values 2:1130r
 critical crevice corrosion temperature (CCT) 2:759, 2:759t, 2:1128, 2:1129r
 depth of localized attacks 2:1127r
 galvanic corrosion 2:849f
 maximum depth of crevice attack 2:1128r
 pitting corrosion 2:1125, 2:1131r
 pitting resistance number (PREN) 2:759, 2:759t, 2:1128–1129, 2:1129r
 stress corrosion cracking (SCC) 2:1125
 304L 2:1126f, 2:1130t, 2:1131r
 316LVM 2:849f, 2:1127f, 2:1129t, 2:1130t, 2:1131r
 testing procedures 2:1146
 titanium alloys 2:1120f, 2:1137
 zinc/zinc alloy corrosion 2:1142, 3:2085
marsh soils 3:2087t, 4:2563r
martensitic stainless steels
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858r
 Sikla bridge (Sweden) 3:1858f
 urban/rural/marine atmospheres 3:1858, 3:1858r
chemical compositions 3:1810t, 3:1812t, 3:1825t, 3:1855t, 3:1863t, 3:1864t, 3:1874r
commercial applications
 art and architecture 3:1858f, 3:1866, 3:1867f, 3:1866f
 domestic products/kitchenware 3:1860, 3:1861r
 process industry
 copper production 3:1862
 corrosion resistance 3:1863
 desalination 3:1863, 3:1865f
 hydrometallurgy 3:1861
 nickel production 3:1862
 oil and gas production 3:1867, 3:1869
 pulp and paper industry 3:1865
 wastewater treatment 3:1870
 zinc production 3:1862
compositional ranges 3:1808r
corrosion properties
 alloy composition influence 3:1825, 3:1826f
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830f
 crevice formers 3:1850f
 critical crevice corrosion temperature (CCT) 3:1850f
 critical pitting temperature (CPT)
 alloying element influences 3:1829f
 basic concepts 3:1827
 grade resistance 3:1847, 3:1848f, 3:1849f
 photographic illustration 3:1829f
 potential dependence 3:1828f
 electrochemical reactions 3:1823, 3:1824f
 electrochemical testing methods 3:1846, 3:1847f
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845f
 general corrosion
 alkaline solutions 3:1843, 3:1844f
 characteristics 3:1838
 hydrochloric acid (HCl) 3:1840, 3:1840f
 nitric acid (HNO₃) 3:1842
 organic acids 3:1842, 3:1843f
 phosphoric acid (H₃PO₄) 3:1841, 3:1841f, 3:1842f
 sulfuric acid (H₂SO₄) 3:1838, 3:1839f, 3:1840f
 general discussion 3:1821
 grade resistance 3:1847, 3:1848f, 3:1849f, 3:1850f
 grade screening methods 3:1849, 3:1850f
 intergranular corrosion 3:1845, 3:1845f
 laboratory tests 3:1850
 localized corrosion 3:1824
 material selection tests 3:1849
 passive films 3:1822, 3:1822f
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826f
 pitting potentials 3:1849f
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825t
 polarization curves 3:1824f
 postweld treatments 3:1837
 stress corrosion cracking (SCC)
 alkaline solutions 2:1200, 3:1833
 atmospheric environments 3:1834, 3:1835f
 characteristics 3:1830, 3:1831f
 chlorine-induced mechanisms 3:1832, 3:1832f
 film-induced cleavage 3:1831
 hydrogen embrittlement 3:1831
 hydrogen-induced stress cracking (HISC) 2:859, 2:859f, 3:1833
 laboratory tests 3:1850
 material selection tests 3:1849
 process mechanisms 3:1831
 slip dissolution 3:1831
 stress intensity factor–crack rate relationship 3:1832, 3:1832f
 sulfide stress cracking (SSC) 2:859, 2:859f, 2:860f, 3:1833
 welding-related corrosion 3:1836
 erosion resistance 2:985f
 fatigue resistance 3:1770t, 3:1771f

- martensitic stainless steels (*continued*)
 flow-induced corrosion 2:983f
 high-temperature stainless steels
 chemical compositions 3:1874r
 corrosion resistance 3:1873
 halogen gas corrosion 3:1876
 molten metal environments 3:1877
 molten salt environments 3:1876
 oxidation behaviors 3:1875, 3:1875f
 sulfur attacks 3:1876
 hydrogen sulfide (H₂S) environments 2:983f
 immersion tests/test compounds 3:1863, 3:1864r
 intergranular corrosion 2:818
 marine corrosion 2:1125
 mechanical properties
 cold work effects 3:1815, 3:1816f
 fatigue properties 3:1816, 3:1816f, 3:1817r
 general discussion 3:1812
 room temperature conditions 3:1812, 3:1813r
 stress-strain plots 3:1813f, 3:1815f
 tempering temperature effects 3:1814f
 toughness impacts 3:1815, 3:1816f
 microstructure 3:1811
 natural water environments
 chlorination effects 3:1852, 3:1852f
 drinking water 3:1853
 freshwater 3:1853, 3:1854f
 general discussion 3:1851
 microbially-induced corrosion (MIC) 3:1851, 3:1852f
 river waters 3:1853
 seawater
 anaerobic conditions 3:1857
 cathodic protection 3:1856
 exposure factors 3:1856, 3:1856r, 3:1857r
 hydrogen embrittlement 3:1856
 materials selection 3:1854, 3:1855f
 polluted environments 3:1855
 resistance factors 3:1854, 3:1855r
 physical properties 3:1819, 3:1820r
 precipitation/embrittlement
 carbide/nitride precipitation 3:1817
 carburization 3:1818
 475°C embrittlement 3:1817
 general discussion 3:1817
 heat treatments
 general discussion 3:1818
 precipitation hardening 3:1819
 quenching 3:1818
 solution annealing 3:1818, 3:1818r
 stabilization annealing 3:1819
 tempering 3:1819
 intermetallic phases 3:1817
 process equipment materials 4:3210–3211
 property relationships 3:1820
 Schaeffler–Delong diagram 3:1811f
 steam and steam/hydrogen environments
 construction materials 1:432t
 general discussion 1:431
 inner scale formation 1:443f
 long-term behavior 1:436, 1:437f, 1:438f, 1:439f
 oxidation rates 1:440f, 1:441f, 1:442f
 pressure effects 1:449, 1:450f
 scale morphology 1:447f, 1:448f, 1:449f, 1:450f
 spalling tendencies 1:439f
 steam oxidation mechanisms 1:433, 1:434f, 1:435f
 temperature dependence effects 1:440, 1:440f, 1:441f, 1:442f, 1:443f, 1:445f
 void and gap formation 1:435, 1:436f, 1:437f, 1:438f, 1:439f
 weight change comparisons 1:433f, 1:442f, 1:444f
 stress corrosion cracking (SCC) 2:867t, 3:1835
 thermal expansion coefficients 1:145f
 welding processes 3:2458
 mass spectrometry (MS) 3:2393
 MAST II Programme 3:1856, 3:1856r
 material properties
 fracture mechanics 1:77–88
 axially cracked pipes 1:83–84, 1:84f
 elastic stress intensity factor (K_I) 1:81, 1:83f
 fracture mechanics test specimens 1:84f
 fracture toughness 1:85, 1:86f
 \mathcal{J} -integral 1:84, 1:85f
 \mathcal{J} R-curve 1:86, 1:86f
 Mode I loading 1:81, 1:82f, 1:83f
 stress corrosion cracking (SCC) 1:86, 1:87f, 1:88f
 mechanical properties 1:77–88
 basic concepts
 elastic–plastic properties 1:80, 1:80f, 1:81f, 1:82f, 1:85–86
 elastic properties 1:78
 general discussion 1:78
 stress–load relationship 1:78, 1:80f
 stress–strain curves 1:79f, 1:80f
 materials selection 4:3052–3064
 aircraft corrosion
 composite materials 4:3184
 high-strength steels 4:3182
 magnesium alloys 4:3183
 titanium alloys 3:2048, 4:3183
 corrosion risk mitigation
 design-based mitigation 4:3065–3083
 activity and information flow diagram 4:3068f
 coating effectiveness 4:3079f
 design process 4:3065, 4:3066f
 environmental chemistry definitions and control 4:3069, 4:3070f, 4:3071f
 flow disturbances 4:3078f, 4:3079f
 fluid entrapment 4:3076f
 galvanic compatibility risks 4:3078, 4:3079f, 4:3080f
 geographic/shape factors 4:3075, 4:3076f, 4:3077f, 4:3078f, 4:3079f
 heat transfer conditions 4:3070, 4:3071f, 4:3072f, 4:3073f
 life cycle costing 4:3066f
 management strategies 4:3080, 4:3080f
 mechanical design factors 4:3073
 microenvironment factors 4:3068, 4:3069f, 4:3070f, 4:3071f, 4:3072f
 performance predictions
 acetic acid–sodium chloride mixtures 4:3059r
 credible corrosion risks 4:3056
 experience-based predictions 4:3057, 4:3058f
 formic acid 4:3060f
 material composition-based predictions 4:3061
 quantitative modeling-based predictions 4:3061
 stress corrosion cracking (SCC) 4:3061f
 testing-based predictions 4:3057, 4:3059f, 4:3061f
 process guidelines 4:3055, 4:3056f
 risk evaluations 4:3062
 design process
 design codes 4:3055, 4:3055f
 design guidelines 4:3052
 engineering material grades 4:3053
 mechanical design guidelines 4:3053, 4:3054f
 economic evaluations 4:3062
 process outputs and records 4:3063
 selection characteristics 4:3063
 maximum likelihood model 2:1553
 mean-spherical approximation (MSA) theory 2:1589, 2:1590r
 mechanical fasteners 3:2449, 3:2450f, 3:2452r
 mechanical properties 1:77–88
 basic concepts
 elastic–plastic properties 1:80, 1:80f, 1:81f, 1:82f, 1:85–86
 elastic properties 1:78
 general discussion 1:78
 stress–load relationship 1:78, 1:80f
 stress–strain curves 1:79f, 1:80f
 medical sensing and electrodes 3:2221
 Mediterranean Sea 2:1109r
 Megger earth resistivity meter 4:2843f
 melt-spinning 3:2192–2193
 membranes, chemically resistant
 asphalt/epoxy mastic 3:2342
 ceramic paper/potassium silicate 3:2343
 fluorocarbons 3:2343, 3:2343r
 general discussion 3:2342
 glass fiber-reinforced resins 2:1223–1224, 3:2343
 lead (Pb) 3:2343
 rubber 3:2343, 3:2343r

- thermoplastic materials 3:2343
vessel linings 3:2345
- mercaptans 4:2490, 4:2992*t*, 4:2993*t*
- mercury (Hg)
anodic protection 4:2874*t*
dental amalgams 2:1310
exchange current density 3:2217*t*
health effects 2:1311
mercury chloride (Hg₂Cl₂) 1:46
mercury oxide (HgO) 3:2197*f*
nitric acid (HNO₃) solutions 2:1252*t*
pitting corrosion potential 2:782*f*
reference electrodes 1:46, 1:47*f*, 1:48*t*, 2:1371*t*
sacrificial anodes 4:2768
- mesa corrosion 4:2902*f*, 4:3293
- metal dusting
adsorbed sulfur protection 1:300, 1:301*f*
alumina-forming alloys 1:639
austenitic iron–nickel (Fe–Ni) alloys 1:296
background information 1:285
cementite decomposition 1:287*f*, 1:288*f*
cementite formation 1:285, 1:286*f*, 1:287*f*
coating protection 1:300
coke filaments 1:286, 1:287*f*
coking rates 1:290*f*, 1:291*f*
environmental conditions 1:402
environment-based alloy selection 1:551
ferritic chromium steels 1:291, 1:292*f*, 1:293*f*
gas composition effects 1:288, 1:290*f*, 1:297
general discussion 1:301
graphite–cementite interface 1:287, 1:289*f*
Hochman–Grabke model 1:286*f*
iron–aluminum (Fe–Al) alloys 1:292
iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
low-alloy steel 1:290, 1:290*f*, 1:291*f*
mass transport model 1:287*f*
nickel alloys 1:293, 1:294*f*, 1:295*f*, 1:296*f*, 1:297*f*
non-cementite iron dusting conditions 1:288, 1:289*f*
oxide scale protection 1:298, 1:299*f*, 1:300*f*
oxide to carbon conversion thermodynamics 1:300*f*
solid oxide fuel cells (SOFCs) 1:497
temperature effects 1:288, 1:290*f*, 1:297
- metallic alloys
corrosion-resistant alloys
body fluids 2:1311, 2:1312*f*
cobalt–chromium–molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
corrosion types
corrosion fatigue 2:944, 2:1318, 3:2049
crevice corrosion 2:1317
fretting corrosion 2:1318
galvanic corrosion 2:1319
general corrosion 2:1316
hydrogen embrittlement 2:1317
pitting corrosion 2:1317
stress corrosion cracking (SCC) 2:1317
dental amalgams 2:1316
health effects 2:1310, 2:1310*t*
historical background 2:1308
magnesium alloys 2:1315
metallic foams 2:1315
nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
niobium (Nb) 3:2148
oral cavity 2:1312–1313
porous materials 2:1315
rare earth magnets 2:1310, 2:1316
safety concerns 2:1308
stainless steels 2:764, 2:1314
surface finish 2:1313
tantalum (Ta) 3:2148
titanium nitride (TiN) coatings 2:1316
titanium/titanium alloys 2:764, 2:1310, 2:1313, 2:1317, 3:2164
wood corrosivity 2:1326
metallic foams 2:1315
metallizing process 4:2535*t*, 4:2541
- metals
acid pickling 4:2491, 4:2491*t*
amorphous alloys 3:2192–2204
alloying element influences
corrosion rates 3:2199*f*
current density dissolution 3:2198*f*
molybdenum (Mo) 3:2198
phosphorus (P) 3:2196, 3:2198*f*
sputter-deposited alloy structures 3:2198*f*
anodic dissolution rates 3:2195, 3:2195*f*
background information 3:2192
bulk metallic glasses
corrosion behavior 3:2199
corrosion-resistant bulk metallic glasses 3:2200
zirconium (Zr)-based bulk metallic glasses 3:2199
enriched alloy layers 3:2196*f*, 3:2197*f*
extremely high corrosion resistance mechanisms 3:2194
hydrochloric acid (HCl) solution testing 3:2193, 3:2193*f*
iron–chromium (Fe–Cr) alloys 3:2194–2195, 3:2195*t*
material types 3:2193
nanocrystalline alloys
conventional corrosion-resistant materials 3:2202
corrosion behavior 3:2201
pitting potential 3:2201*f*
precipitated materials 3:2201
repassivation potential 3:2201*f*
passive films 2:727, 3:2194–2195, 3:2195*t*, 3:2196*f*
pitting corrosion 3:2193–2194, 3:2194*f*
archaeological metals 2:1159, 4:3310, 4:3311*f*, 4:3312*f*
cast iron corrosion 3:1774
ceramics–metals comparisons 1:670
- coatings
intermetallic alloys
aluminide coatings 1:663
general discussion 1:662
laser cladding (LC) 4:2624
laser gas nitriding (LGS) 4:2632, 4:2632*f*, 4:2633*t*
metal–chromium–aluminum–yttrium (MCrAlY) coatings
aluminum depletion 1:709
characteristics 1:696, 4:2550
compositions 1:696*t*
cracking 1:706, 1:707*f*, 1:708*f*
estimated effective fracture energies 1:709*t*
finite-element modeling predictions 1:708, 1:708*f*
gas turbines 1:537*f*
microstructure 1:697*f*
protective oxidation 1:705, 1:706*f*
spalling tendencies 1:706, 1:707*f*, 1:708*f*, 1:709*t*
steam and steam/hydrogen environments 1:449, 1:450*f*, 1:451*f*, 1:452*f*
structure 1:697*f*
metallic glass coatings 4:2617
metallic sprayed coatings 4:2618, 4:2626
metal matrix composite (MMC) coatings 4:2626–2627
- corrosion behavior 1:671
- corrosion test methods
chemical reactions 2:1496
general discussion 2:1495
impurity reactions 2:1496
liquid–metal embrittlement 2:1500
mass transfer 2:1496
simple solutions 2:1496
testing methods
dynamic tests 2:1498
general discussion 2:1497
loop tests 2:1498, 2:1498*f*
refluxing capsules 2:1497
static tests 2:1497
- corrosive environments 1:405
electroplated coatings 4:2578
galvanic series 2:831*f*
high-temperature oxidation behavior 1:180–194
alumina (Al₂O₃) scale growth 148
chromia (Cr₂O₃) scale growth 148, 1:413, 1:414*f*
general discussion 1:180, 1:193
metal–aluminum (M–Al) alloys 1:612, 1:612*f*, 1:613*f*
metal–chromium–aluminum (MCrAl) alloys 1:613, 1:614*f*, 1:615*f*
nitridation processes

- metals (*continued*)
- basic concepts 1:260
 - corrosion mechanisms 1:262
 - environment-based alloy selection 1:549, 1:550*f*, 1:551*f*
 - predictive modeling 1:261*f*, 1:262
 - pressure effects 1:263*f*, 1:264*f*, 1:265*f*
 - thermochemistry 1:262
 - transition stages 1:265*f*
 - oxide scale growth 1:146
 - parabolic rate constant plot 1:146*f*, 1:147*f*
 - Pilling–Bedworth ratio (PBR) 1:146*t*
 - pure metal reactions
 - dual-oxidant thermodynamic reactions 1:184
 - Ellingham diagram 1:183*f*
 - general discussion 1:181
 - metal oxide transport properties 1:187, 1:188*f*, 1:189*f*
 - phase stability diagram 1:184, 1:184*f*, 1:185*f*
 - scale formation kinetics 1:186
 - single-oxidant thermodynamic reactions 1:181, 1:182*t*, 1:183*f*
 - Wagner's theory of internal oxidation 1:188, 1:189*f*
 - reactive element effects
 - general discussion 1:146
 - location detection 1:148
 - oxide scale adherence 1:148
 - oxide scale growth kinetics 1:147*f*, 1:148
 - oxide scale growth mechanisms 1:148
 - scale development 1:613*f*
 - scale formation kinetics
 - basic concepts 1:186
 - linear rate law 1:187
 - logarithmic rate law 1:187
 - parabolic rate law 1:186, 1:187*f*
 - spalling tendencies 1:144
 - steam and steam/hydrogen environments
 - general discussion 1:416
 - nomenclature 1:417
 - protective scale-forming elements (PSEs) 1:416, 1:417*f*
 - temperature–aluminum content relationship 1:612*f*, 1:613*f*
 - thermal expansion coefficients 1:145*f*
 - historical metals 4:3313, 4:3313*f*
 - hydrometallurgy
 - copper production 3:1862
 - general discussion 3:1861
 - nickel production 3:1862
 - zinc production 3:1862
 - intermetallic alloys 1:646–667
 - aluminide coatings
 - alloyed aluminide coatings 1:663, 1:664*f*, 1:665*f*
 - different base–different substrate 1:665, 1:665*f*
 - gas turbines 1:537*f*
 - high-temperature coatings 1:701, 1:701*f*
 - platinum aluminides 4:2544, 4:2545*f*, 4:2546*f*, 4:2547*f*, 4:2549*f*
 - same base–same substrate 1:663
 - simple aluminide coatings 1:663
 - uranium alloys 3:2188
 - applications 1:646
 - coatings
 - aluminide coatings 1:537*f*, 1:663, 1:701, 1:701*f*
 - general discussion 1:662
 - laser cladding (LC) 4:2624, 4:2633*t*
 - common intermetallic alloys
 - crystal structure 1:648*f*
 - general discussion 1:646
 - iron aluminides (FeAl/Fe₃Al) 1:292, 1:609*t*, 1:648, 1:648*f*, 1:650, 1:650*f*
 - nickel aluminides (NiAl/Ni₃Al) 1:547*f*, 1:609*t*, 1:623*f*, 1:646, 1:648*f*, 1:649*f*, 1:650, 1:652*f*, 1:654*f*
 - titanium aluminides (TiAl/Ti₃Al) 1:145*f*, 1:648*f*, 1:649, 1:651*f*
 - copper–gold (Cu–Au) alloys 2:805*f*, 2:867*t*, 3:2215
 - general discussion 1:646, 1:666
 - hot corrosion
 - alumina-forming alloys 1:638
 - chlorine-containing environments 1:661, 1:662*f*
 - general discussion 1:660
 - sulfur-containing environments 1:660
 - oxidation processes
 - Ellingham diagram 1:652*f*
 - general discussion 1:649
 - iron aluminides (FeAl/Fe₃Al) 1:650
 - nickel aluminides (NiAl/Ni₃Al) 1:547*f*, 1:623*f*, 1:650, 1:652*f*, 1:654*f*
 - platinum aluminides 1:659
 - titanium aluminides (TiAl/Ti₃Al) 1:656
 - silver–gold (Ag–Au) alloys 2:803*f*, 2:805*f*, 2:806*f*, 2:867*t*, 3:2215
 - ionizing radiation effects
 - aqueous environments
 - chemical plant heating/cooling waters 2:1334
 - general discussion 2:1332
 - light water reactors (LWRs) 2:1333, 2:1333*f*
 - nitric acid solutions 2:1337
 - polymer degradation materials 2:1337
 - atmospheric environments 2:1337
 - general discussion 2:1331
 - test considerations 2:1338
 - joints/joining processes 3:2447–2462
 - aluminum alloys 3:2461
 - basic concepts 3:2447
 - carbon steel 3:2456, 3:2457*f*
 - insulated joints 3:2450*f*
 - low-alloy steel 3:2456, 3:2457*f*
 - mechanical fasteners 3:2449, 3:2450*f*, 3:2452*t*
 - nickel alloys 3:2461
 - protective treatments 3:2461
 - soldering and brazing methods
 - brazed joints 3:2451
 - filler materials 3:2450, 3:2451*t*
 - fluxes 3:2451*t*
 - general discussion 3:2450
 - joining processes 3:2452*t*
 - soldered joints 3:2450
 - traditional alloys 3:2451*t*
 - stainless steels
 - austenitic stainless steels 3:2458, 3:2459*f*
 - common corrosion sites 3:2458*f*
 - duplex stainless steels 3:2459
 - ferritic stainless steels 3:2458, 3:2459*f*
 - general discussion 3:2458
 - localized corrosion 3:2460
 - martensitic stainless steels 3:2458
 - sensitization conditions 3:2460, 3:2460*f*
 - welded joints
 - fusion welding 3:2452*t*, 3:2453*f*
 - resistance welding 3:2452*t*, 3:2453*f*
 - solid-phase welding 3:2452*t*
 - weldability factors 3:2453*t*
 - weld defects 3:2453, 3:2453*f*, 3:2454*f*, 3:2454*t*
 - welding processes 3:2452, 3:2452*t*, 3:2453*f*
 - weldment corrosion factors 3:2453
 - weldment corrosion factors
 - filler metal composition 3:2456
 - general discussion 3:2453
 - postweld heat treatment (PWHT) 3:2455
 - residual stresses 3:2455, 3:2455*f*
 - welding technique 3:2454
 - weld joint design 3:2453, 3:2455*f*
 - kinetic mechanisms 1:671
 - liquid metal corrosion 3:1774
 - metal chloride vapor pressure–temperature plot 1:403*f*
 - metal dusting
 - adsorbed sulfur protection 1:300, 1:301*f*
 - alumina-forming alloys 1:551, 1:639
 - background information 1:285
 - cementite decomposition 1:286–287, 1:287*f*, 1:288*f*
 - cementite formation 1:285, 1:286*f*, 1:287*f*
 - coating protection 1:300
 - coke filaments 1:286, 1:287*f*
 - coking rates 1:290*f*, 1:291*f*
 - ferritic chromium steels 1:291, 1:292*f*, 1:293*f*
 - gas composition effects 1:288, 1:290*f*, 1:297
 - general discussion 1:301
 - graphite–cementite interface 1:287, 1:289*f*
 - Hochman–Grabke model 1:286*f*
 - iron–aluminum (Fe–Al) alloys 1:292
 - iron–chromium–aluminum (Fe–Cr–Al) alloys 1:292
 - low-alloy steel 1:290, 1:290*f*, 1:291*f*

- mass transport model 1:287f
- nickel alloys
 austenitic iron–nickel (Fe–Ni) alloys 1:296, 1:297
 carbon uptake kinetics 1:297f
 gas composition effects 1:297
 graphitization process 1:294f, 1:295f, 1:296f
 nickel–copper (Ni–Cu) alloys 1:296, 1:296f
 reaction morphologies 1:293
 temperature effects 1:297
- non-cementite iron dusting conditions 1:288, 1:289f
 oxide scale protection 1:298, 1:299f, 1:300f
 oxide to carbon conversion thermodynamics 1:300f
 risk management strategies 4:3224–3226, 4:3225f
 temperature effects 1:288, 1:290f, 1:297
- metal–environment interaction effects
 chemical reactions 1:92
 crystal structure imperfections 1:94f
 environmental conditions 1:92, 1:95f
 general discussion 1:89
 metal heterogeneities 1:93, 1:93t, 1:94f
- metallic–ceramic coatings 4:3188, 4:3188t
- metallic coating protection 4:2519–2531
 alternative coating systems 4:2528
 anodic protection 4:2520
 cathodic protection 4:2520
 control options 2:1166
 galvanized steel 2:1166f
 general discussion 4:2519
 metallic–ceramic coatings 4:3188, 4:3188t
 metal whiskers 4:2529, 4:2530f
 multilayer coatings 4:2528
 practical applications
 aluminum (Al) 2:1165, 4:2525
 cadmium (Cd) 4:2524
 chromium (Cr) 4:2526
 copper (Cu) 4:2525
 lead (Pb) 4:2525
 nickel (Ni) 4:2525
 precious metals 4:2526, 4:2526f, 4:2527f
 tin (Sn) 4:2525
 zinc coatings 2:1165, 4:2524
- research developments
 environmental classification 4:2528, 4:2528t
 galvanic coupling 4:2527
 general discussion 4:2526
 porosity 4:2528
- selection factors
 application methods 4:2521
 coating properties 4:2523
 corrosion resistance 4:2521
 economic factors 4:2524
 galvanic coupling compatibility 4:2522, 4:2522t
 substrate property effects 4:2523
- sprayed coatings 4:2618, 4:2626
- metallic cultural heritage preservation 4:3307–3340
 challenges 4:3337f, 4:3338
 coatings
 coating types 4:3328
 conservation-specific coatings 4:3324, 4:3325f
 patinas 4:3326, 4:3327f, 4:3328f
 surface preparation 4:3327, 4:3328f
 conservation efforts 4:3308
 conservation rationale 4:3309
 conservation standards 4:3309
- corrosion
 archaeological metals 2:1159, 4:3310, 4:3311f, 4:3312f
 conservation strategies 4:3310
 handling concerns 4:3313–3314, 4:3314f
 historical metals 4:3313, 4:3313f
 modern metals 4:3313–3314
- ethical practices 4:3310
 future developments 4:3337
- inhibitors
 benzotriazole (BTA) 4:3332, 4:3333f
 carboxylates 4:3334
 general discussion 4:3332
 tannins 4:3334, 4:3335f
- interventive treatments
 chloride removal 4:3318
 electrolytic techniques 4:3321, 4:3323f, 4:3324f
 hydrogen reduction 4:3323
 soluble ion removal techniques 4:3317
 stripping techniques 4:3320
 washing methods 4:3318, 4:3318f
- painted metals
 paint removal methods 4:3335
 refinishing methods 4:3335, 4:3336f
 preservation goals 4:3309
- preventive conservation
 deoxygenation 4:3317
 desiccation 4:3314
 practical humidity control 4:3315
 relative humidity threshold values 4:3314, 4:3315f, 4:3316f
- metallic glasses
 background information 3:2192–2193
 corrosion behavior 3:2199
 corrosion-resistant bulk metallic glasses 3:2200
 metallic glass coatings 4:2617
 zirconium (Zr)-based bulk metallic glasses 3:2199
- metallic oxide vulcanization 3:2437
- metallurgical structure effects
 steel 3:2458
- metal–matrix composites 3:2250–2269
 characteristics 3:2251
 chemical degradation
 aluminum carbide (Al₄C₃) hydrolysis 3:2263
 general discussion 3:2262
 mica degradation 3:2263
 continuous-reinforced metal–matrix composites
 characteristics 3:2251, 3:2251f
 practical applications 3:2252, 3:2253f
 corrosion characteristics
 chemical degradation 3:2262
 electrochemical effects 3:2253
 environmental conditions 3:2264
 general discussion 3:2253
 interphase effects 3:2262
 secondary effects 3:2263
 corrosion protection methods 3:2267
 discontinuous-reinforced metal–matrix composites
 characteristics 3:2252, 3:2252f
 practical applications 3:2252, 3:2253f
 electrochemical effects
 anodic/cathodic polarization diagram 3:2254f, 3:2255f, 3:2256f
 cathodic constituent content 3:2260, 3:2261f
 cathodic current densities 3:2260, 3:2260t
 environmental conditions 3:2254, 3:2255f
 general discussion 3:2253
 localized corrosion 3:2259, 3:2259f, 3:2261f, 3:2262f
 matrix metal corrosion 3:2254, 3:2255f
 microstructure 3:2259, 3:2259f
n-type semiconductors 3:2256, 3:2256f
p-type semiconductors 3:2256, 3:2256f
 reinforcement area fraction 3:2258, 3:2258f, 3:2259f
 reinforcement electrochemistry 3:2255, 3:2256f
 reinforcement photoelectrochemistry 3:2256
 reinforcement resistivity 3:2257, 3:2257t, 3:2258f
 environmental conditions
 general discussion 3:2264
 humidity chamber exposure 3:2266, 3:2266f
 immersion exposure 3:2265, 3:2265f
 outdoor exposure 3:2266, 3:2267f, 3:2267t
 general discussion 3:2267
 resistivities 3:2257t
 secondary effects
 dislocation density 3:2264
 general discussion 3:2263
 intermetallic alloys 3:2263, 3:2263t
 low-integrity diffusion bonds 3:2264
 microstructural chlorides 3:2264, 3:2264f
 processing-induced corrosion 3:2264
 modern metals 4:3313–3314
 natural waters 2:1095

- metals (*continued*)
- nonferrous metals 4:2491, 4:2491*r*
 - painted metals
 - paint removal methods 4:3335
 - refinishing methods 4:3335, 4:3336*f*
 - passive metals
 - basic concepts 4:2860
 - passivation potential 4:2860*f*
 - polarization curve potential–current density plot 4:2860*f*, 4:2862*f*
 - passivity
 - anodic polarization curves 2:732*f*, 2:733*f*, 2:734*f*, 2:735, 2:735*f*
 - basic concepts
 - anodic polarization curves 2:732*f*, 2:733*f*, 2:734*f*
 - general discussion 2:731
 - chemical/electrochemical passivity 2:733*f*, 2:734*f*, 2:743
 - corrosion rate determination 2:734
 - film compositions 2:746
 - kinetic mechanisms 2:737
 - nonaqueous liquids 2:744
 - oxide film growth mechanisms 2:737
 - passivity breakdown 2:735*f*, 2:747, 2:1621, 3:1824
 - thermodynamics
 - basic concepts 2:740
 - potential–pH (Pourbaix) diagram 2:742*f*
 - precious metals 4:2526, 4:2526*f*, 4:2527*f*
 - solid oxide fuel cells (SOFCs) 1:484
 - structural metallurgy 1:52–76
 - alloys
 - complex alloy systems 1:75
 - components and phases 1:62
 - dislocation-based segregation 1:63
 - equilibrium phase diagrams 1:63
 - general discussion 1:61
 - grain boundary-based segregation 1:63
 - intermediate phases/intermetallic compounds 1:63
 - iron–iron carbide (Fe–Fe₃C) phase diagram 1:66
 - limited and complete solid solubility 1:63
 - solid solutions 1:62, 1:62*f*
 - equilibrium phase diagrams
 - binary isomorphous phase diagrams 1:64, 1:64*f*
 - complex binary phase diagrams 1:66, 1:67*f*, 1:68*f*, 1:69*f*, 1:70*f*
 - coring 1:65
 - eutectic phase diagrams 1:65, 1:65*f*, 1:66*f*
 - general discussion 1:63
 - general discussion 1:52
 - iron–iron carbide (Fe–Fe₃C) phase diagram
 - austenite decomposition 1:66
 - bainite formation 1:70, 1:71*f*
 - general discussion 1:66
 - hypo-eutectoid steel transformation 1:71, 1:72*f*
 - iron-rich end 1:69*f*
 - isothermal transformation diagrams 1:71, 1:71*f*, 1:72*f*
 - martensite formation 1:70, 1:71*f*
 - martensite tempering 1:72, 1:73*f*
 - pearlite formation 1:69, 1:70*f*, 1:71*f*
 - spheroidized structures 1:73
 - pure metals
 - annealing processes 1:60
 - characteristics 1:52, 1:55*t*
 - close-packed structure 1:55*f*
 - dislocations 1:57, 1:58*f*, 1:59*f*
 - grains and grain boundaries 1:58, 1:59*f*, 1:60*f*, 1:61*f*
 - line defects 1:56, 1:57*f*
 - macroscopic defects 1:60
 - point defects 1:54, 1:56*f*
 - polycrystalline metals 1:58
 - stacking faults and twins 1:55, 1:56*f*
 - surface structure/surface defects 1:60, 1:61*f*
 - unit cells 1:54*f*
 - strengthening mechanisms
 - complex alloy systems 1:75
 - general discussion 1:73
 - inclusions 1:59*f*, 1:76
 - precipitation hardening 1:74, 1:74*f*, 1:75*f*
 - titanium aluminides (TiAl/Ti₃Al) 1:360, 1:363*f*, 1:364*f*
 - unified numbering system (UNS) 4:3053
 - amorphous silica 3:2316
 - wood
 - corrosivity 2:1323–1329
 - corrosion test methods 2:1326
 - general discussion 2:1323
 - industrial significance
 - background information 2:1327
 - conservation efforts 2:1328
 - construction materials 2:1327
 - water cooling towers 2:1328, 3:2444
 - water tanks 2:1328
 - wood cutting tools 2:1328
 - mechanisms
 - acid content 2:1324, 2:1325*t*
 - acidic vapor corrosion 2:1326
 - aluminum/aluminum alloys 2:1326
 - bimetallic corrosion 2:1325
 - contact corrosion 2:1324
 - copper/copper alloys 2:1326
 - general discussion 2:1324
 - lead (Pb) 2:1326
 - moisture content 2:1324
 - polyphenolic compounds 2:1325
 - salt content 2:1325
 - wood degradation effects 2:1325, 3:2442, 3:2445
 - modeling methods 2:1327
 - metal-working lubricants 2:1305
 - methane (CH₄)
 - atmospheric gases 2:1053*t*
 - carburation rates 1:266–267, 1:269*f*
 - flue gas composition 1:462*t*
 - solid oxide fuel cells (SOFCs) 1:497*t*
 - transport mechanisms 2:1067*f*
 - methanol 2:1285, 3:2380*t*
 - methoxymethane 3:2380*t*
 - methoxypropylamine 4:2977
 - methyl acrylate 3:1909
 - methyl bromide (CH₃Br) 2:1067*f*
 - methyl butyl acetate 3:2380*t*
 - methylcyclohexane 3:2380*t*
 - methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 - methylethyl ketoxime 4:2976–2977, 4:2976*t*
 - methyl methacrylate 3:2371
 - methylpropanoate 3:2380*t*
 - methylpropene 3:2380*t*
 - methyl vinyl ether (MVE) 4:2966
 - micro arc oxidation (MAO) 3:2034
 - microarc oxidation (MAO) 4:2514–2515
 - microbially-induced corrosion (MIC) 2:1169–1190
 - acid-producing bacteria (APBs) 4:2949
 - airframe corrosion 2:1181, 4:3177, 4:3178*t*, 4:3180*t*
 - carbon steel 3:1713
 - cast iron
 - action mechanisms 3:1775
 - gelatinous vesicle development 3:1775, 3:1776*f*
 - general discussion 3:1774
 - iron-oxidizing bacteria 3:1775
 - prevention strategies 3:1776
 - sulfate-reducing bacteria (SRB) 3:1775
 - copper/copper alloy corrosion 3:1956, 3:1957*f*
 - electrochemical causal factors 2:1173
 - freshwater environments 3:1956, 3:1957*f*
 - general aerobic bacteria (GAB) 4:2920
 - general discussion 2:1170
 - industrial heating and cooling systems 4:2949, 4:2949*f*, 4:2967, 4:2969*t*
 - iron-oxidizing bacteria 3:1775
 - iron-related bacteria (IRBs) 4:2949
 - marine environments 2:1111
 - microorganisms
 - algae 2:1172
 - bacteria 2:1170, 2:1179
 - biofilms 2:1111, 2:1172, 2:1173*f*, 2:1182, 4:2922*f*, 4:2920
 - characteristics 2:1170
 - fungi 2:1172, 2:1181
 - oil and gas industry
 - bacteria monitoring techniques/serial dilution 4:2922*f*, 4:2920
 - biocide application procedures 4:2922

- biocide treatments 4:2922
corrosion effects 4:2922*f*, 4:2920
- operating condition-based risk assessments
anaerobic conditions 2:1186
antimicrobial chemical treatments 2:1186
cleaning frequency 2:1186
flow rate 2:1186
general discussion 2:1185
nutrient availability 2:1186
pH 2:1185
salinity 2:1185
temperature conditions 2:1185
water presence 2:1185
- pipeline corrosion management 4:3279, 4:3295
- potable water systems 4:2949, 4:2949*f*, 4:2967, 4:2969*t*
- protective treatments
biocidal coatings 2:1187
biocide treatments
application methods 4:2922
basic concepts 4:2922
chlorination 2:1187, 3:1852, 3:1852*f*, 4:2922
organic biocides 2:1188, 4:2922
cathodic protection 2:1186
nitrogen-based treatments 2:1188
nonaggressive surrounds 2:1186
protective coatings 2:1186
- seawater-based aerobic biofilms 2:1182
- soil corrosion 2:1156
- stainless steels 3:1851, 3:1852*f*
- sulfate-reducing bacteria (SRB)
acid corrosion
concrete degradation 2:1180
fungi 2:1181
sulfuric acid (H₂SO₄) 2:1179, 2:1180*f*, 2:1181*f*
- black water corrosion 2:1175*f*, 2:1176
- cast iron 3:1775
- copper/copper alloys 2:1178, 2:1178*f*
Desulfovibrio spp. 2:1174, 2:1174*f*
environmental conditions 2:1174, 2:1175*f*, 2:1176*f*
Gallionella spp. 2:1177, 2:1178*f*, 2:1183, 4:2920
industrial heating and cooling systems 4:2949
iron corrosion 2:1176, 2:1177*f*
lead (Pb) 3:2063
low-alloy steel 2:1176, 2:1177*f*
oil and gas industry 4:2920
pipeline corrosion management 4:3279, 4:3295
soil corrosion 2:1156, 2:1161
stainless steels 2:1176, 2:1177*f*, 2:1178*f*
- testing procedures
chemical analyses 2:1184–1185
general discussion 2:1183
serial dilution test 2:1183*f*
side stream test device 2:1184*f*
wastewater treatment 3:1871
zirconium/zirconium alloys 3:2110
- microbiological fouling 4:2950, 4:2950*f*, 4:2967, 4:2969*t*
- microcrystalline waxes 4:3330
- microscopy 2:1405–1429
atomic force microscopy (AFM)
background information 2:1439
general discussion 2:1441
implementation processes 2:1440
limitations 2:1440
operating principles 2:1439, 2:1439*f*
solid/liquid interface applications 2:1440, 2:1441*f*
basic concepts 2:1405
chemical analyses
electron energy loss spectroscopy (EELS) 2:1408, 2:1421, 2:1423*f*
electron probe microanalysis (EPMA) 2:1420, 2:1422*f*
X-ray analysis
basic concepts 2:1418
line scan profile 2:1420*f*
schematic diagram 2:1419*f*
spectral data plot 2:1419*f*, 2:1420*f*
electrochemical scanning tunnel microscopy (ECSTM)
background information 2:1433
electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*
general discussion 2:1441
implementation processes 2:1433, 2:1434*f*
limitations 2:1433
solid/liquid interface applications
active dissolution of metals 2:1434, 2:1435*f*
general discussion 2:1434
passive film growth and structure analysis 2:1436, 2:1437*f*
electron microscopy
electron energy loss spectroscopy (EELS) 1:383, 1:385*f*, 2:1408, 2:1421, 2:1423*f*
electron probe microanalysis (EPMA) 2:1420, 2:1422*f*
operational principles
basic concepts 2:1408
electron and X-ray generation 2:1408*f*, 2:1409*f*
incident electron beam–thin foil interactions 2:1408*f*
scanning electron microscopy (SEM)
backscattered electrons 2:1409–1410, 2:1410*f*, 2:1411*f*
basic concepts 2:1409
cementite analysis 1:286, 1:287*f*
characteristics 2:1376*t*
corrosion product characterizations 1:140, 1:142*f*
electron backscatter diffraction (EBSD) 2:880–881, 2:882*f*, 2:1411, 2:1413*f*
environmental scanning electron microscopy (ESEM) 2:1412
'glaze' formation analyses 1:383
secondary electrons 2:1409–1410, 2:1410*f*
specimen preparation techniques 2:1415*f*, 2:1425
topographic images 2:1410–1411, 2:1412*f*
X-ray analyses 2:1419, 2:1419*f*
specimen preparation techniques
scanning electron microscopy (SEM) 2:1425
transmission electron microscopy (TEM) 2:1424, 2:1425*f*
transmission electron microscopy (TEM)
basic concepts 2:1412
bright field (BF) images 2:1413–1414, 2:1414*f*
cementite analysis 1:286, 1:287*f*
convergent beam electron diffraction (CBED) 2:1417
corrosion product characterizations 1:140, 1:142*f*
dark field (DF) images 2:1413–1414, 2:1414*f*
electron beam damage effects 2:1415, 2:1415*f*
electron diffraction 2:1417, 2:1417*f*
'glaze' formation analyses 1:379, 1:381*f*, 1:383
high angle annular dark field (HAADF) images 1:382*f*, 1:383, 1:384*f*, 1:385*f*, 1:386*f*, 1:387*f*, 1:388*f*, 2:1414*f*
high-resolution transmission electron microscopy (HRTEM) 2:1415, 2:1416*f*
nickel graphitization 1:294, 1:295*f*
scanning transmission electron microscopy (STEM) 1:382*f*, 1:383, 1:384*f*, 1:385*f*, 1:386*f*, 1:387*f*, 1:388*f*, 2:1416
selected area diffraction (SAD) 2:1417
specimen preparation techniques 2:1415*f*, 2:1424, 2:1425*f*
TEM tomography 2:1416
X-ray analyses 2:1418–1419, 2:1419*f*, 2:1420*f*
X-ray analysis
basic concepts 2:1418
line scan profile 2:1420*f*
schematic diagram 2:1419*f*
spectral data plot 2:1419*f*, 2:1420*f*
energy dispersive X-ray (EDX) microscopy
corrosion product characterizations 1:140
corrosion studies 2:1406, 2:1406*f*, 2:1419*f*, 2:1420*f*
'glaze' formation analyses 1:383, 1:384*f*, 1:385*f*, 1:386*f*, 1:387*f*, 1:388*f*, 1:389*f*, 1:392*t*
optical microscopy
basic concepts 2:1407
corrosion studies
heat-affected zone (HAZ) 2:1406–1407, 2:1406*f*
magnesium alloys 2:1408*f*
Raman spectroscopy 2:1427, 2:1428*f*
research developments 2:1428
scanning electron microscopy (SEM)
backscattered electrons 2:1409–1410, 2:1410*f*, 2:1411*f*
basic concepts 2:1409
cementite analysis 1:286, 1:287*f*
characteristics 2:1376*t*
corrosion product characterizations 1:140, 1:142*f*

- microscopy (*continued*)
- corrosion studies 2:1406, 2:1406f
 - electron backscatter diffraction (EBSD) 2:880–881, 2:882f, 2:1411, 2:1413f
 - environmental scanning electron microscopy (ESEM) 2:1412
 - 'glaze' formation analyses 1:383
 - secondary electrons 2:1409–1410, 2:1410f
 - specimen preparation techniques 2:1415f, 2:1425
 - topographic images 2:1410–1411, 2:1412f
 - X-ray analyses 2:1419, 2:1419f
 - scanning probe microscopy 2:1430–1442
 - atomic force microscopy (AFM)
 - background information 2:1439
 - general discussion 2:1441
 - implementation processes 2:1440
 - limitations 2:1440
 - operating principles 2:1439, 2:1439f
 - solid/liquid interface applications 2:1440, 2:1441f
 - background information 2:1431
 - electrochemical scanning tunnel microscopy (ECSTM)
 - background information 2:1433
 - electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438f
 - general discussion 2:1441
 - implementation processes 2:1433, 2:1434f
 - limitations 2:1433
 - solid/liquid interface applications 2:1434, 2:1435f
 - scanning tunnel microscopy (STM)
 - background information 2:1431
 - general discussion 2:1441
 - 'glaze' formation analyses 1:379
 - limitations 2:1432
 - operating principles 2:1431, 2:1432f
 - scanning tunnel spectroscopy (STS) 1:379, 2:1432
 - solid/gas interface applications 2:1432
 - scanning tunnel microscopy (STM)
 - background information 2:1431
 - general discussion 2:1441
 - 'glaze' formation analyses 1:379
 - limitations 2:1432
 - operating principles 2:1431, 2:1432f
 - scanning tunnel spectroscopy (STS) 1:379, 2:1432
 - solid/gas interface applications 2:1432
 - specimen preparation techniques
 - scanning electron microscopy (SEM) 2:1425
 - transmission electron microscopy (TEM) 2:1424, 2:1425f
 - transmission electron microscopy (TEM)
 - basic concepts 2:1412
 - bright field (BF) images 2:1413–1414, 2:1414f
 - cementite analysis 1:286, 1:287f
 - convergent beam electron diffraction (CBED) 2:1417
 - corrosion product characterizations 1:140, 1:142f
 - corrosion studies 2:1406, 2:1406f
 - dark field (DF) images 2:1413–1414, 2:1414f
 - electron beam damage effects 2:1415, 2:1415f
 - electron diffraction 2:1417, 2:1417f
 - 'glaze' formation analyses 1:379, 1:381f, 1:383
 - high angle annular dark field (HAADF) images
 - aluminum alloy cross-section 2:1414f
 - Nimonic alloys–Stellite 6 wear-affected surfaces study 1:382f, 1:383, 1:384f, 1:385f, 1:386f, 1:387f, 1:388f
 - high-resolution transmission electron microscopy (HRTEM) 2:1415, 2:1416f
 - nickel graphitization 1:294, 1:295f
 - scanning transmission electron microscopy (STEM)
 - characteristics 2:1416
 - Nimonic alloys–Stellite 6 wear-affected surfaces study 1:382f, 1:383, 1:384f, 1:385f, 1:386f, 1:387f, 1:388f
 - selected area diffraction (SAD) 2:1417
 - specimen preparation techniques 2:1415f, 2:1424, 2:1425f
 - TEM tomography 2:1416
 - X-ray analyses 2:1418–1419, 2:1419f, 2:1420f
 - X-ray microscopy 2:1425
 - X-ray tomography 2:1426, 2:1426f
 - microsilica 3:2354
 - mild steel
 - acid gas corrosion 2:1270–1298
 - aqueous carbon dioxide (CO₂) corrosion
 - carbon dioxide (CO₂) partial pressure effects 2:1281, 2:1282f, 2:1283f
 - carbonic acid (H₂CO₃) reduction reactions 2:1278
 - carbonic species concentrations 2:1275f
 - characteristics 2:1273
 - condensation effects 2:1285
 - corrosion inhibitors 2:1284
 - corrosion rate calculations 2:1280
 - crude oil effects 2:1285
 - electrochemical reactions 2:1277
 - equilibrium relations 2:1273, 2:1274f, 2:1275f
 - flow effects 2:1283, 2:1284f
 - glycol/methanol effects 2:1285
 - hydronium (H⁺) ion reduction reactions 2:1278
 - influencing factors 2:1281
 - iron carbonate (FeCO₃) 2:1275f, 2:1276f, 2:1290f
 - localized corrosion 2:1286
 - mixed hydrogen sulfide–carbon dioxide (H₂S–CO₂) saturated
 - aqueous solutions 2:1289, 2:1292
 - modeling approaches 2:1280, 2:1281f
 - nonideal solutions/gases 2:1286
 - organic acid effects 2:1285
 - oxidation reactions 2:1278
 - pH effects 2:1274f, 2:1281, 2:1282f
 - solubility calculations 2:1287f
 - temperature effects 2:1282, 2:1283f
 - transport processes 2:1279
 - water (H₂O) reduction reactions 2:1279
 - aqueous hydrogen sulfide (H₂S) corrosion
 - characteristics 2:1286
 - corrosion rate calculations 2:1291, 2:1294f, 2:1296f
 - corrosion rate predictions 2:1297f
 - equilibrium relations 2:1287
 - flow effects 2:1295, 2:1295f
 - hydrogen sulfide (H₂S) partial pressure effects 2:1293, 2:1293f, 2:1294f
 - influencing factors 2:1293
 - iron sulfide (FeS) surface layer 2:1289f, 2:1290f
 - localized corrosion 2:1297
 - mixed hydrogen sulfide–carbon dioxide (H₂S–CO₂) saturated
 - aqueous solutions 2:1289, 2:1292
 - modeling limitations 2:1292
 - pH effects 2:1287f
 - pure hydrogen sulfide (H₂S) aqueous environment 2:1291
 - solubility calculations 2:1287f, 2:1289f
 - solubility product constants 2:1288f
 - sulfide species calculations 2:1287f
 - time effects 2:1294f, 2:1295, 2:1296f
 - background information 2:1273
 - alloying element influences 3:1724f
 - cathodic protection criteria 4:2847f
 - corrosion rates 3:1702f
 - millscale formation 4:2487
 - phosphate coatings 4:2494
 - stress corrosion cracking (SCC) 2:867f
 - millscale formation 4:2487
 - mineral acids
 - cast iron corrosion 3:1766
 - glass enamel corrosion 3:2073, 3:2326
 - lead corrosivity 3:2063
 - niobium corrosion 3:2144, 3:2145f
 - tantalum corrosion 3:2144, 3:2145f
 - mineral base oils 2:1300
 - mineral scales
 - chemical compositions 4:2942f
 - closed-loop water systems 4:2943
 - cooling systems 4:2943, 4:2943f
 - general discussion 4:2941
 - new-construction HVAC systems 4:2944
 - potable water lines 4:2944
 - steam boiler systems 4:2941, 4:2942f
 - mining industry 4:2994
 - misfit dislocations 1:109f
 - misses/skips/holidays 4:2739
 - Mississippi Chemical (US) 3:2131
 - mixed dislocation 1:104, 1:105f
 - Mode I loading 1:81, 1:82f, 1:83f

- modeling approaches 2:1581–1584
 computational fluid dynamics 2:985
 methodologies 2:1582
 purposes 2:1581
 spatial distribution
 boundary element method (BEM) 2:1584
 finite difference methods (FDM) 2:1583, 2:1583f
 finite element methods (FEM) 2:1583
 general discussion 2:1582
 modern metals 4:3313–3314
 mold casting techniques 3:1983
 molds 4:2949, 4:2950
 molten carbonate fuel cells (MCFCs) 1:328
 molten salts 1:316–330
 analytical methods
 electrochemical techniques
 cyclic voltammogram 1:324f
 general discussion 1:323
 Nyquist plot of impedance data 1:325f
 polarization curves 1:324f
 set-up diagram 1:323f
 multisample exposure tests 1:323
 thermogravimetric tests 1:325
 background information 1:316
 carbonate melts
 characteristics 1:319
 gas solubility 1:319
 oxide solubility 1:320, 1:320f, 1:321f
 redox reactions 1:319
 corrosion test methods
 chemical reactions 2:1496
 general discussion 2:1495
 impurity reactions 2:1496
 liquid–metal embrittlement 2:1500
 mass transfer 2:1496
 simple solutions 2:1496
 testing methods
 dynamic tests 2:1498
 general discussion 2:1497
 loop tests 2:1498, 2:1498f
 refluxing capsules 2:1497
 static tests 2:1497
 corrosive environments
 aluminum alloys 3:2000
 chlorine-containing environments 1:662, 1:662f
 general discussion 1:405
 sulfur-containing environments 1:661, 1:661f
 diffusion coatings 4:2535t, 4:2541
 fireside corrosion
 alloy corrosion resistance 1:480, 1:480f
 basic concepts 1:468, 1:469f
 chlorine-related corrosion 1:477, 1:479f
 coal constituents 1:475f
 corrosion rates 1:473f
 fused salts 1:479–480, 1:480f
 oxide basicity 1:477f
 oxide solubility 1:476f
 sulfate-induced corrosion 1:461f, 1:472, 1:473f, 1:474f, 1:477f, 1:478f
 vanadium attacks 1:470, 1:470f, 1:471f, 1:472f
 high-temperature stainless steels 3:1876
 hot-salt corrosion
 chloride melts 1:326, 1:327f, 1:327t, 1:328f
 gas turbines 1:325
 molten carbonate fuel cells (MCFCs) 1:328
 sodium sulfate (Na_2SO_4) 1:325, 1:326f
 waste incineration 1:326, 1:327f, 1:328f
 zinc chloride (ZnCl_2)–potassium chloride (KCl) mixtures
 chromium chloride (CrCl_2) solubility 1:329f
 iron chloride ($\text{FeCl}_2/\text{FeCl}_3$) solubility 1:328f
 nickel chloride (NiCl_2) solubility 1:329f
 waste incineration corrosion 1:328, 1:328f
 noble metals 3:2219
 sulfate melts
 background information 1:316
 gas solubility 1:317
 oxide solubility 1:320, 1:320f, 1:321f
 Rapp–Goto corrosion criterion 1:322, 1:322f, 1:323f
 redox reactions
 basic concepts 1:317
 chronopotentiometric curve 1:319f
 limiting diffusion current density 1:318f
 thermodynamics 1:317
 zirconium corrosivity 3:2127
 molybdenum (Mo) 3:2157–2167
 age-hardenable nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
 alloys
 alumina-forming alloys 1:608t, 1:609t
 amorphous alloys 3:2193–2194, 3:2194f, 3:2198, 3:2198f
 aqueous corrosive environments 3:2163
 characteristics 3:2161
 chromia-forming alloys 1:608t, 1:609t
 chromium–molybdenum (Cr–Mo) alloys 1:466f, 1:468f, 1:589
 cobalt-based alloys 3:1918, 3:1918t
 cobalt–chromium–molybdenum (CoCrMo) alloy
 corrosion fatigue 2:1318
 corrosion resistance 2:764, 2:1314, 3:1927
 crevice corrosion 2:1317
 galvanic corrosion 2:1319, 3:1928
 historical background 2:1310
 hydrogen embrittlement 2:1317
 pitting corrosion 2:1317
 replacement joints 2:1046f, 2:1047f
 zirconium (Zr)-based bulk metallic glasses 3:2200
 compositions 1:246t
 corrosion-resistant alloys 2:1308
 heat-resisting alloys–carburization effects 1:283
 intermetallic alloys 1:656, 1:658
 iron–chromium–molybdenum (Fe–Cr–Mo) alloys 3:2233, 3:2234t, 3:2241
 iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
 low-alloy steel 1:569
 nickel–molybdenum (Ni–Mo) alloys
 corrosion resistance 3:1884, 3:1885f
 galvanic corrosion 2:851t
 historical development 3:1882t
 intergranular corrosion 2:819
 laser surface alloying (LSA) 4:2631
 major alloying elements 3:1881, 3:1881t
 time–temperature–notch impact energy diagram 3:1885f
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 silicon–molybdenum iron (Si–Mo Fe) alloys 4:2784
 stainless steels 2:1232–1233, 2:1233f, 3:1809
 thermal expansion coefficients 1:145f
 Ti15Mo5Zr3Al alloy 2:1313, 3:2164
 Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 titanium molybdenum (TiMo) alloys 2:1312–1313
 uranium–molybdenum (U–Mo) alloys 3:2182, 3:2182t
 anodic protection 4:2874t, 4:2888
 applications 3:2159
 aqueous corrosion
 corrosion processes
 corrosion rates 3:2162t
 galvanic corrosion 3:2163
 general discussion 3:2163
 high-temperature water 3:2163
 molybdenum alloys 3:2163
 oxidizing environments 3:2163
 electrochemistry
 anodic behavior 3:2161
 passivation 3:2161
 potential–pH (Pourbaix) diagram 3:2161f, 3:2162f
 thermodynamics 3:2161
 corrosion-resistant coatings 4:2995
 corrosivity
 aqueous corrosion 3:2161
 high-temperature corrosion 1:466f, 3:2164
 reducing environments 1:468f
 crystal structure 1:55t
 diffusion coatings 4:2535t, 4:2536t
 fabrication processes 3:2159, 3:2160t
 high-temperature corrosion
 fused materials

- molybdenum (Mo) (*continued*)
 liquid metals 3:2165
 molten glasses 3:2165
 gaseous environments
 carburization 3:2165
 halide-containing environments 3:2165
 nitridation 3:2165
 oxidation 3:2164, 3:2164*t*
 sulphidation 3:2164
 protective treatments 3:2166
 inhibitive pigments 4:2652
 laser surface alloying (LSA) 4:2631
 mechanical properties 3:2137*t*, 3:2158, 3:2158*t*
 molybdenum disilicide (MoSi₂) 1:145*f*, 1:209, 1:210*f*, 1:552, 3:2301
 molybdenum nitride (Mo₂N) 1:308*f*
 molybdenum oxide (MoO₂) 1:542*f*
 molybdenum oxide (MoO₃) 1:160*t*, 1:204*f*, 1:205, 1:477*f*, 3:2197*f*
 molybdenum sulfide (MoS₂) 3:2164
 nickel-based superalloys 1:693*t*
 nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
 alloy 20
 corrosion resistance 3:1891
 galvanic corrosion 2:831*f*, 2:1119*f*
 historical development 3:1882*t*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 maximum depth of crevice attack 2:1128*t*
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 alloy 31
 acetic acid production 3:1908
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 corrosion rates 3:1905*f*, 3:1911*f*
 corrosion resistance 3:1892, 3:1900
 fine and specialty chemicals 3:1910
 historical development 3:1882*t*
 hydrochloric acid (HCl) isocorrosion diagram 3:1894*f*
 major alloying elements 3:1881*t*
 phosphoric acid (H₃PO₄) production 3:1905, 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*, 3:1900, 3:1901*t*
 pollution controls 3:1912
 stability limits 3:1895*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237*f*, 3:1893*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 tank transport studies 3:1912
 alloy 33
 alkali corrosion 2:1200*f*
 caustic soda (NaOH) production 3:1902, 3:1902*f*
 corrosion loss measurements 3:1896*t*, 3:1897*t*
 corrosion resistance 3:1892, 3:1896*f*
 historical development 3:1882*t*
 major alloying elements 3:1881*t*
 pitting resistance 3:1894*f*, 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 alloy 825
 alkali corrosion 2:1200*f*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 hydrohalic acid corrosion 2:1217*f*, 2:1219*f*
 major alloying elements 3:1881*t*
 nuclear waste isolation 2:767
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*, 2:1243*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 vinyl chloride monomer (VCM) production 3:1908
 alloy G-3
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 alloy G-30
 corrosion loss measurements 3:1896*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 major alloying elements 3:1881*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 laser surface alloying (LSA) 4:2631
 major alloying elements 3:1881, 3:1881*t*
 nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 above-water fastener selection 2:847*f*
 alloy 22
 corrosion loss diagram 3:1888*f*
 corrosion resistance 3:1887
 hydrohalic acid corrosion 2:1217*f*, 2:1219*f*, 2:1220*f*
 major alloying elements 3:1881*t*
 nuclear waste isolation 2:767
 thermal stability 3:1890*t*
 time–temperature–sensitization diagram 3:1891*f*
 alloy 59
 acetic acid production 3:1908
 corrosion loss diagram 3:1888*f*
 corrosion rates 3:1889*f*, 3:1905*f*, 3:1911*f*
 corrosion resistance 3:1887, 3:1900
 fine and specialty chemicals 3:1910
 hydrochloric acid (HCl) isocorrosion diagram 3:1888*f*
 hydrofluoric acid (HF) production 3:1907
 hydrohalic acid corrosion 2:1217*f*, 2:1219*f*
 major alloying elements 3:1881*t*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 phosphoric acid (H₃PO₄) production 3:1906*f*
 pitting resistance 3:1894*f*
 pollution controls 3:1912
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1888*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 tank transport studies 3:1912
 thermal stability 3:1890*t*, 3:1891*f*
 time–temperature–sensitization diagram 3:1891*f*
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1908
 alloy 625
 acrylic acid/acrylate ester production 3:1909
 alkali corrosion 2:1200*f*
 corrosion loss diagram 3:1888*f*
 corrosion rates 3:1889*f*
 corrosion resistance 3:1890, 3:1899
 galvanic corrosion 2:849*f*
 hydrohalic acid corrosion 2:1217*f*, 2:1219*f*
 major alloying elements 3:1881*t*
 nuclear waste isolation 2:767
 phosphoric acid (H₃PO₄) production 3:1905
 pitting resistance 3:1894*f*, 3:1900
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1243*f*
 thermal expansion coefficients 1:145*f*
 time–temperature–sensitization diagram 3:1891*f*
 vinyl chloride monomer (VCM) production 3:1908
 alloy 686
 corrosion resistance 3:1889
 hydrohalic acid corrosion 2:1217*f*, 2:1219*f*
 major alloying elements 3:1881*t*
 thermal stability 3:1890*t*, 3:1891*f*
 time–temperature–sensitization diagram 3:1891*f*
 alloy 2000
 corrosion resistance 3:1889
 hydrohalic acid corrosion 2:1218*f*, 2:1219*f*, 2:1220*f*
 major alloying elements 3:1881*t*
 sulfuric acid (H₂SO₄) environments 2:1241*f*, 2:1247*f*
 thermal stability 3:1890*t*, 3:1891*f*
 time–temperature–sensitization diagram 3:1891*f*
 alloy C-4
 corrosion loss diagram 3:1888*f*
 corrosion resistance 3:1887, 3:1900
 hydrohalic acid corrosion 2:1220*f*

- major alloying elements 3:1881r
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
thermal expansion coefficients 1:145f
time-temperature-sensitization diagram 3:1891f
toluene di-isocyanate (TDI) 3:1909
- alloy C-276
acetic acid production 3:1908
acrylic acid/acrylate ester production 3:1909
corrosion loss diagram 3:1888f
corrosion rates 3:1889f
corrosion resistance 3:1886, 3:1900
galvanic corrosion 2:849f
hydrofluoric acid (HF) production 3:1907
hydrohalic acid corrosion 2:1217f, 2:1219f, 2:1220f
major alloying elements 3:1881r
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
phosphoric acid (H₃PO₄) production 3:1906f
pitting resistance 3:1894f, 3:1900
pollution controls 3:1912
styrene production 3:1908
sulfuric acid (H₂SO₄) environments 2:1238f, 2:1240f, 2:1243f
sulfuric acid (H₂SO₄) isocorrosion diagram 3:1887f
sulfuric acid (H₂SO₄) production and handling 3:1903
thermal expansion coefficients 1:145f
thermal stability 3:1890r
time-temperature-sensitization diagram 3:1891f
toluene di-isocyanate (TDI) 3:1909
vinyl chloride monomer (VCM) production 3:1908
- alloy MAT 21 3:1881r, 3:1889
below-water fastener selection 2:849f
fireside corrosion 1:480f
flow-induced corrosion 2:982f
galvanic corrosion 2:831f, 2:1119f
general discussion 3:1886
historical development 3:1882r
hydrochloric acid (HCl) corrosion 2:1215f, 2:1216f
hydrofluoric acid (HF) corrosion 2:1214f
intergranular corrosion 2:819
major alloying elements 3:1881, 3:1881r
materials selection 2:982f
- occurrence 3:2157
oxidation processes 1:204f, 1:205
physical properties 3:2136r, 3:2158, 3:2158r
production processes 3:2157-2158
- stainless steels
alloying elements 2:1232-1233, 2:1233f, 3:1809
grades
chemical compositions 3:1810r, 3:1812r, 3:1825r, 3:1863r
seawater corrosion 3:1856r
testing environments 3:1864r
- surgical implants
cobalt-chromium-molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
environmental conditions 2:1311
health effects 2:1310, 2:1310r
- monoethanolamine 4:2977
Monte Carlo (MC) techniques 2:1550f
montmorillonite 2:1154
morpholine 4:2977, 4:2998r
- mortars
silicate-based mortars 3:2341, 3:2342r
synthetic and natural resins
epoxy resins 3:2342, 3:2342r
furane resin 3:2341, 3:2342r
phenolic resins 3:2342, 3:2342r
polyester resins 3:2342
vessel linings 3:2345
- Mott-Schottky analysis 2:1642-1643
muck 3:2087r, 4:2563r
mud cracking 4:2739
- muds
chemical compositions 4:2942r
closed-loop water systems 4:2943
cooling systems 4:2943, 4:2943f
general discussion 4:2941
new-construction HVAC systems 4:2944
potable water lines 4:2944
steam boiler systems 4:2941, 4:2942f
mullite 3:2296, 3:2302f, 3:2340
multiple linear regression models 2:1553
multistage flash (MSF) process 3:1863
municipal solid waste 1:459, 1:459r, 1:460f, 1:460r, 1:464r, 1:465f
muscovite mica 3:2257r, 3:2263
Mycobacterium avium 4:2951-2952
- ## N
- nails, archaeological 4:3312f, 4:3313f, 4:3318f
nail sickness 2:1325, 3:2442-2443, 3:2445
nanocrystalline alloys
conventional corrosion-resistant materials 3:2202
corrosion behavior 3:2201
dealloying applications 2:802
pitting potential 3:2201f
precipitated materials 3:2201
repassivation potential 3:2201f
- nanosilica 3:2354
nanostructured coatings 4:2617
nanotubes 3:2274, 3:2279f
National Association of Corrosion Engineers (NACE) 4:3057
natural gas 1:459, 1:459r, 1:460f, 1:460r
natural rubber *see* rubber
natural waters *see* water (H₂O)
Navier-Stokes equations 2:1649
near edge X-ray absorption fine structure (NEXAFS) spectroscopy 2:1396-1397
- neodymium (Nd)
alumina-forming alloys 1:608r, 1:609r
chromia-forming alloys 1:608r, 1:609r
magnesium alloys 3:2014-2015
Nd:YAG (neodymium-doped yttrium aluminum garnet) laser 3:2024, 4:2623
- neon (Ne) 2:1053r
neoprene 3:2473, 3:2473f
Nernst diffusion layer 1:22, 1:22f, 1:39f, 1:683, 2:1602-1603
Nernst-Einstein relation 1:116, 2:1611-1613, 2:1648-1649
Nernst equation
chemical potential 1:8
ionic solutions 1:27
M²⁺/M couple 1:25, 1:26r
out-of-equilibrium conditions 1:38, 1:39f
potential-pH (Pourbaix) diagram
aluminum (Al) 1:31, 1:32f
general discussion 1:28
gold (Au) 1:30, 1:30f
iron (Fe) 1:30-31, 1:31f
pH and potential-dependent equilibrium 1:29, 1:29f
purely pH-dependent equilibrium 1:29, 1:29f
purely potential-dependent equilibrium 1:28, 1:29f
redox couples equilibrium potential values 1:26r
uniform corrosion 2:725-726
- Nernst's diffusion boundary layer calculation 1:683
neural network methods 2:1680-1692
austenitic stainless steel pitting potential case study
carbonate concentration effects 2:1689f
chloride concentration effects 2:1688f
general discussion 2:1687
hydroxide concentration effects 2:1690f
nitrate concentration effects 2:1689f
sulfate concentration effects 2:1688f
temperature effects 2:1690f
- basic concepts
general discussion 2:1681-1682
layered structure 2:1682f
limitations 2:1682
sigmoidal transfer function 2:1681f
confidence fitting techniques 2:1684, 2:1685f
general discussion 2:1690
inconsistent data sets 2:1686
industrial applications 2:1682
training data requirements 2:1686
variance estimations 2:1684, 2:1684f

- neutral cleaners 4:2485
neutral glasses 3:2307, 3:2308*t*, 3:2309*t*
neutralizing amine treatments 4:2977, 4:2986
Newbuilding shipyard 4:2685, 4:2689
new-construction HVAC systems 4:2944
new rheo-casting (NRC) process 3:2022
- nickel (Ni)
acid pickling 4:2992*t*
age-hardenable nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
alloy 400
acrylic acid/acrylate ester production 3:1909
alkali corrosion 2:1200*f*
hydrofluoric acid (HF) production 2:1214*f*, 3:1907
marine environments 2:1135, 2:1136*t*
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
oxidizing environments 2:1240*f*
styrene production 3:1908
sulfuric acid (H₂SO₄) environments 2:1247*f*
velocity factors 2:1241*f*
vinyl chloride monomer (VCM) production 3:1908
alloy 600
alkali corrosion 2:1200*f*, 2:1202–1203, 2:1203*f*
aqueous corrosive environments 2:1136*t*, 3:1902, 3:1908
hydrofluoric acid (HF) corrosion 2:1214*f*
stress corrosion cracking (SCC) 2:867*t*
amorphous alloys 3:2193
anodic protection 4:2874*t*
aqueous corrosive environments 3:1879–1915
age-hardenable nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
alloy 28
corrosion loss measurements 3:1894*t*, 3:1895*t*, 3:1896*t*, 3:1897*t*
phosphoric acid (H₃PO₄) production 3:1905
pitting potential 3:1895*f*
alloy 39 3:1911*f*
alloy 200 3:1902, 3:1908
alloy 201 3:1902, 3:1902*f*
alloy 316 2:1238*f*, 2:1247*f*, 3:1897*t*
alloy 400
acrylic acid/acrylate ester production 3:1909
hydrofluoric acid (HF) production 2:1214*f*, 3:1907
marine environments 2:1135, 2:1136*t*
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
oxidizing environments 2:1240*f*
styrene production 3:1908
sulfuric acid (H₂SO₄) environments 2:1247*f*
velocity factors 2:1241*f*
vinyl chloride monomer (VCM) production 3:1908
alloy 600 2:1136*t*, 3:1902, 3:1908
alloy 617 3:1908
alloy 690 2:1238*f*, 3:1896*t*
alloy 800 2:1136*t*, 3:1908
alloy 904L 2:1238*f*, 3:1897*t*, 3:1906*f*, 4:3059*t*, 4:3060*f*
alloy 926
acrylic acid/acrylate ester production 3:1909
corrosion loss measurements 3:1894*t*, 3:1895*t*
hydrofluoric acid (HF) production 3:1907
phosphoric acid (H₃PO₄) production 3:1906*f*
pitting potential 3:1895*f*
pitting resistance 3:1894*f*, 3:1897*t*
pollution controls 3:1914
stability limits 3:1895*f*
styrene production 3:1908
vinyl chloride monomer (VCM) production 3:1908
alloy B-2 2:1238*f*, 2:1240*f*, 3:1903, 3:1907, 3:1908, 3:1909, 3:1911*f*, 4:3058*f*
background information 3:1881
chemical process industry and environmental technology
acetic acid production 3:1907
acrylic acid/acrylate ester production 3:1909
caustic soda (NaOH) production 3:1902
fine and specialty chemicals 3:1910
general discussion 3:1901
hydrofluoric acid (HF) production 3:1907
methylene di-*para*-phenylene isocyanate (MDI) 3:1909
phosphoric acid (H₃PO₄) production 3:1905
pollution controls 3:1912
styrene production 3:1908
sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
tank transport studies 3:1912
toluene di-isocyanate (TDI) 3:1909
vinyl chloride monomer (VCM) production 3:1908
corrosion resistance 3:1882, 3:1883*f*
general discussion 3:1880
historical development 3:1882*t*
nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
alloy 20 2:831*f*, 2:1119*f*, 2:1128*t*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*
alloy 31 2:1237*f*, 3:1892
alloy 33 2:1238*f*, 3:1892
alloy 825 2:767, 2:1238*f*, 2:1243*f*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1897*t*, 3:1908
alloy G-3 3:1881*t*, 3:1882*t*, 3:1891, 3:1894*t*, 3:1907
alloy G-30 2:1238*f*, 3:1881*t*, 3:1882*t*, 3:1891, 3:1896*t*
corrosion resistance 3:1891
historical development 3:1882*t*
major alloying elements 3:1881, 3:1881*t*
nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
alloy 22 2:767, 3:1881*t*, 3:1887, 3:1888*f*, 3:1890*t*, 3:1891*f*
alloy 59 3:1887
alloy 625 1:145*f*, 2:767, 2:849*f*, 2:1243*f*, 3:1890
alloy 686 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
alloy 2000 2:1241*f*, 2:1247*f*, 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
alloy C-4 1:145*f*, 3:1881*t*, 3:1887, 3:1888*f*, 3:1891*f*, 3:1900
alloy MAT 21 3:1881*t*, 3:1889
general discussion 3:1886
historical development 3:1882*t*
major alloying elements 3:1881, 3:1881*t*
nickel–chromium (Ni–Cr) alloys
corrosion resistance 3:1885, 3:1886*f*
historical development 3:1882*t*
major alloying elements 3:1881, 3:1881*t*
nickel–copper (Ni–Cu) alloys
corrosion resistance 3:1883
galvanic corrosion 2:1119*f*
historical development 3:1882*t*
major alloying elements 3:1881, 3:1881*t*
nickel–molybdenum (Ni–Mo) alloys
corrosion resistance 3:1884, 3:1885*f*
historical development 3:1882*t*
major alloying elements 3:1881, 3:1881*t*
time–temperature–notch impact energy diagram 3:1885*f*
principal alloys 3:1881, 3:1881*t*
welded-state corrosion behavior
heat-affected zone (HAZ) 3:1894–1895, 3:1898, 3:1898*f*
intercrystalline corrosion (IC) 3:1894–1895, 3:1900
pitting resistance 3:1900
surface conditions and treatment 3:1899
atmospheric corrosion 2:848*f*
carbon dioxide (CO₂) environments 2:855*f*
coating characteristics 4:2525
cobalt-based alloys 3:1918*t*
cobalt–chromium–molybdenum (CoCrMo) alloy 2:1314
copper–nickel–beryllium (CuNiBe) intermetallic compound 3:2177
corrosion potential 4:2591*t*
corrosion resistance 3:1882, 3:1883*f*
crystal structure 1:55*t*
diffusion coatings 4:2535*t*
electrochemical scanning tunnel microscopy (ECSTM) 2:1436
electroplated coatings 4:2584
Ellingham diagram 1:652*f*
erosion resistance 2:985*f*
exchange current density 3:2217*t*
galvanic corrosion 2:850*t*, 2:851*t*, 2:1119*f*
galvanizing zinc melts 4:2570
hydrogen sulfide (H₂S) environments 2:855*f*
laser surface alloying (LSA) 4:2631
magnesium alloys 3:2016*t*, 3:2019*t*
nickel alloys 2:767

- aircraft corrosion 4:3188*t*
- alkali corrosion
 alloying element influences 2:1200*f*
 corrosion rates 2:1200, 2:1202*f*, 2:1203*f*
 nickel–water system Pourbaix diagram 2:1201*f*
 temperature effects 2:1202*f*
- alloy 59
 acetic acid production 3:1908
 corrosion loss diagram 3:1888*f*
 corrosion rates 3:1889*f*, 3:1905*f*, 3:1911*f*
 corrosion resistance 3:1887, 3:1900
 fine and specialty chemicals 3:1910
 hydrochloric acid (HCl) isocorrosion diagram 3:1888*f*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 phosphoric acid (H₃PO₄) production 3:1906*f*
 pitting resistance 3:1894*f*
 pollution controls 3:1912
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1888*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 tank transport studies 3:1912
 thermal stability 3:1890*t*, 3:1891*f*
 time–temperature–sensitization diagram 3:1891*f*
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1908
- alloy 20
 corrosion resistance 3:1891
 galvanic corrosion 2:831*f*, 2:1119*f*
 historical development 3:1882*t*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 maximum depth of crevice attack 2:1128*t*
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 625
 acrylic acid/acrylate ester production 3:1909
 corrosion loss diagram 3:1888*f*
 corrosion rates 3:1889*f*
 corrosion resistance 3:1890, 3:1899
 galvanic corrosion 2:849*f*
 major alloying elements 3:1881*t*
 nuclear waste isolation 2:767
 phosphoric acid (H₃PO₄) production 3:1905
 pitting resistance 3:1894*f*, 3:1900
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1243*f*
 thermal expansion coefficients 1:145*f*
 time–temperature–sensitization diagram 3:1891*f*
 vinyl chloride monomer (VCM) production 3:1908
- alloy 31
 acetic acid production 3:1908
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 corrosion rates 3:1905*f*, 3:1911*f*
 corrosion resistance 3:1892, 3:1900
 fine and specialty chemicals 3:1910
 historical development 3:1882*t*
 hydrochloric acid (HCl) isocorrosion diagram 3:1894*f*
 major alloying elements 3:1881*t*
 phosphoric acid (H₃PO₄) production 3:1905, 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*, 3:1900, 3:1901*t*
 pollution controls 3:1912
 stability limits 3:1895*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237*f*, 3:1893*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904*f*, 3:1905*f*
 tank transport studies 3:1912
- alloy 33
 caustic soda (NaOH) production 3:1902, 3:1902*f*
 corrosion loss measurements 3:1896*t*, 3:1897*t*
 corrosion resistance 3:1892, 3:1896*f*
 historical development 3:1882*t*
 major alloying elements 3:1881*t*
 pitting resistance 3:1894*f*, 3:1897*t*
- sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
- alloy 400
 acrylic acid/acrylate ester production 3:1909
 alkali corrosion 2:1200*f*
 hydrofluoric acid (HF) production 2:1214*f*, 3:1907
 marine environments 2:1135, 2:1136*t*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 oxidizing environments 2:1240*f*
 styrene production 3:1908
 sulfuric acid (H₂SO₄) environments 2:1247*f*
 velocity factors 2:1241*f*
 vinyl chloride monomer (VCM) production 3:1908
- alloy 600
 alkali corrosion 2:1200*f*, 2:1202–1203, 2:1203*f*
 aqueous corrosive environments 2:1136*t*, 3:1902, 3:1908
 hydrofluoric acid (HF) corrosion 2:1214*f*
 stress corrosion cracking (SCC) 2:867*t*
- alloy 617 3:1908
- alloy 690 2:1238*f*, 3:1896*t*
- alloy 800 2:1136*t*, 3:1908
- alloy 904L 2:1238*f*, 3:1897*t*, 3:1906*f*, 4:3059*t*, 4:3060*f*
- alloy 926
 acrylic acid/acrylate ester production 3:1909
 corrosion loss measurements 3:1894*t*, 3:1895*t*
 hydrofluoric acid (HF) production 3:1907
 phosphoric acid (H₃PO₄) production 3:1906*f*
 pitting potential 3:1895*f*
 pitting resistance 3:1894*f*, 3:1897*t*
 pollution controls 3:1914
 stability limits 3:1895*f*
 styrene production 3:1908
 vinyl chloride monomer (VCM) production 3:1908
- alloy B-2 2:1238*f*, 2:1240*f*, 3:1903, 3:1907, 3:1908, 3:1909, 3:1911*f*, 4:3058*f*
- alloy C-276
 acetic acid production 3:1908
 acrylic acid/acrylate ester production 3:1909
 corrosion loss diagram 3:1888*f*
 corrosion rates 3:1889*f*
 corrosion resistance 3:1886, 3:1900
 galvanic corrosion 2:849*f*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 phosphoric acid (H₃PO₄) production 3:1906*f*
 pitting resistance 3:1894*f*, 3:1900
 pollution controls 3:1912
 styrene production 3:1908
 sulfuric acid (H₂SO₄) environments 2:1238*f*, 2:1240*f*, 2:1243*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1887*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 thermal expansion coefficients 1:145*f*
 thermal stability 3:1890*t*
 time–temperature–sensitization diagram 3:1891*f*
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1908
- alumina-forming alloys **1:606–645**
 breakaway oxidation 1:634
 compositions 1:607, 1:608*t*, 1:609*t*
 creep rupture life 1:611*f*
 environmental conditions 1:637
 functionality 1:607
 general discussion 1:640
 hydrogen permeability 1:612*f*
 selective oxidation 1:612
 spalled oxide mass 1:610*f*, 1:617*f*
 steady-state oxidation 1:621
 total mass gain 1:607, 1:610*f*, 1:614*f*, 1:617*f*
 transient oxidation 1:617
- anhydrous hydrogen halide gases/hydrohalic acids
 alloy 2000 2:1218*f*
 alloy B 2:1217*f*
 alloy B-3 2:1218*f*
 compositions 2:1213*t*
 corrosion rates 2:1212

- nickel (Ni) (*continued*)
- hydrobromic acid (HBr) 2:1217f
 - hydrochloric acid (HCl) 2:1214f, 2:1215f, 2:1216f, 2:1217f, 2:1218f, 2:1220f
 - hydrofluoric acid (HF) 2:1214f, 2:1219f
 - aqueous corrosive environments 3:1879–1915
 - acetic acid production 3:1907
 - acrylic acid/acrylate ester production 3:1909
 - age-hardenable nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1898
 - alloy 28 3:1894t, 3:1895f, 3:1895t, 3:1896t, 3:1897t, 3:1905
 - alloy 39 3:1911f
 - alloy 200 3:1902, 3:1908
 - alloy 201 3:1902, 3:1902f
 - alloy 316 2:1238f, 2:1247f, 3:1897t
 - alloy 600 2:1136t, 3:1902, 3:1908
 - alloy 617 3:1908
 - alloy 690 2:1238f, 3:1896t
 - alloy 800 2:1136t, 3:1908
 - alloy 904L 2:1238f, 3:1897t, 3:1906f, 4:3059t, 4:3060f
 - alloy B-2 2:1238f, 2:1240f, 3:1903, 3:1907, 3:1908, 3:1909, 3:1911f, 4:3058f
 - background information 3:1881
 - caustic soda (NaOH) production 3:1902
 - chemical process industry and environmental technology 3:1901
 - fine and specialty chemicals 3:1910
 - general discussion 3:1880
 - heat-affected zone (HAZ) 3:1898, 3:1898f
 - historical development 3:1882t
 - hydrofluoric acid (HF) production 3:1907
 - intercrystalline corrosion (IC) 3:1894–1895, 3:1900
 - materials selection 2:982f
 - methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 - nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1881, 3:1881t, 3:1882t, 3:1891
 - nickel–chromium–molybdenum (Ni–Cr–Mo) alloys 3:1881, 3:1881t, 3:1882t, 3:1886
 - nickel–chromium (Ni–Cr) alloys 3:1881, 3:1881t, 3:1882t, 3:1885, 3:1886f
 - nickel–copper (Ni–Cu) alloys 2:1119f, 3:1881, 3:1881t, 3:1882t, 3:1883
 - nickel–molybdenum (Ni–Mo) alloys 3:1881, 3:1881t, 3:1882t, 3:1884, 3:1885f
 - phosphoric acid (H₃PO₄) production 3:1905
 - pitting resistance 3:1900
 - pollution controls 3:1912
 - principal alloys 3:1881, 3:1881t
 - styrene production 3:1908
 - sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904f, 3:1905f
 - surface conditions and treatment 3:1899
 - tank transport studies 3:1912
 - toluene di-isocyanate (TDI) 3:1909
 - vinyl chloride monomer (VCM) production 3:1886–1887, 3:1908
 - welded-state corrosion behavior 3:1898
 - austenitic iron–nickel (Fe–Ni) alloys 1:296, 1:297
 - austenitic nickel cast iron 3:1744, 3:1744f, 3:1745t, 3:1756t
 - brazed joints 3:2451
 - carburation
 - dissolution thermodynamics 1:275t
 - permeability data 1:276t
 - reaction morphologies 1:276
 - thermodynamic properties 1:276
 - cobalt-based alloys 3:1918t
 - cobalt–nickel–chromium–aluminum–yttrium (CoNiCrAlY) alloys 1:537f, 4:2552
 - comparison studies 1:595t
 - compositions 1:246t, 2:1213t, 2:1242t
 - copper–nickel–chromium (Cu–Ni–Cr) alloys 3:1943
 - crevice corrosion 2:759–760
 - cupronickel alloys 3:1942, 3:1952t, 3:1967
 - diffusion coefficients 1:307t
 - ferritic chromium steels 1:501t
 - galvanic corrosion 3:1757t
 - Inconel alloys 1:354
 - intergranular corrosion 2:819, 2:823t, 2:825t
 - internal corrosion risks 4:3217f, 4:3218f
 - iron- and nickel-based superalloys 1:310, 1:311f
 - iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
 - iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
 - iron–nickel–cobalt (Fe–Ni–Co) alloys 1:551f
 - iron–nickel (Fe–Ni) alloys 3:1789–1801
 - acid corrosion 3:1792, 3:1792t
 - atmospheric corrosion 3:1790, 3:1791f, 3:1791t
 - carburation 1:296, 1:297
 - diffusion coefficients 1:307t
 - electrochemistry 3:1790, 3:1790f
 - fireside corrosion 1:472f
 - freshwater environments 3:1791
 - galvanic corrosion 3:1793, 3:1794t
 - general discussion 3:1790
 - industrial environments 3:1792
 - nitridation processes 1:307t
 - phase diagram 1:70f
 - salt solutions 3:1792
 - seawater corrosion 3:1791, 3:1791t, 3:1792t
 - stress corrosion cracking (SCC) 3:1793, 3:1793t
 - iron–nickel–sulfur (Fe–Ni–S) alloys 1:244f, 1:245f
 - low-alloy steels 1:568
 - maraging steels
 - acid corrosion 3:1795
 - applications 3:1800
 - atmospheric corrosion 3:1795, 3:1797f
 - compositions 3:1793, 3:1795t
 - fabrication processes 3:1794
 - industrial environments 3:1795
 - mechanical properties 3:1794, 3:1796t
 - natural environments 3:1795
 - physical properties 3:1795t
 - seawater corrosion 3:1795, 3:1797f
 - stress corrosion cracking (SCC) 3:1796
 - structural characteristics 3:1794
 - marine corrosion 2:1135, 2:1136t
 - metal dusting 1:293, 1:294f, 1:295f, 1:296f, 1:297
 - nickel aluminides (NiAl/Ni₃Al)
 - alumina scale formation 1:547f, 1:623f, 1:652f, 1:654f
 - aluminide coatings 1:665, 1:665f, 3:2188
 - characteristics 1:646
 - chlorine-containing environments 1:661
 - coefficients of thermal expansion (CTEs) 1:632f
 - compositions 1:609t
 - crystal structure 1:104, 1:648f
 - dislocations 1:106–107
 - internal oxidation 1:633
 - microstructure 1:651
 - parabolic rate constants 1:624t
 - partial pressure effects 1:654
 - phase diagram 1:649f
 - porosity 1:651
 - reactive element additions 1:227t, 1:655
 - scale adhesion 1:223
 - scale properties 1:650
 - sulfur-containing environments 1:660
 - sulfur impurities 1:230, 1:231f, 1:654–655
 - water vapor effects 1:637, 1:638f, 1:654
 - nickel–chromium–aluminum (Ni–Cr–Al) alloys
 - base metal oxide formation 1:617, 1:618f, 1:619f
 - compositions 1:609t, 1:693t
 - depletion profiles 1:695f
 - diffusion-controlled internal nitridation 1:307f
 - high-temperature oxidation 1:613, 1:614f, 1:692, 1:693f
 - nitridation processes 1:639
 - oxide map 1:614f
 - platinum-group metal effects 1:616
 - reactive element additions 1:227t
 - specimen mass gain 1:619f
 - sulfur impurities 1:230, 1:231f
 - thermodynamic stability 1:308, 1:308f
 - nickel–chromium–aluminum–yttrium (NiCrAlY) alloys 1:615–616, 1:632f, 1:639
 - nickel–chromium–cobalt (Ni–Cr–Co) alloys 1:250

- nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
 alloy 20 2:831*f*; 2:1119*f*; 2:1128*t*; 3:1881*t*; 3:1882*t*; 3:1891, 3:1897*t*
 alloy 825 2:767, 2:1238*f*; 2:1243*f*; 3:1881*t*; 3:1882*t*; 3:1891, 3:1897*t*, 3:1908
 alloy G-3 3:1881*t*, 3:1882*t*, 3:1891, 3:1894*t*, 3:1907
 alloy G-30 2:1238*f*; 3:1881*t*, 3:1882*t*, 3:1891, 3:1896*t*
 corrosion resistance 3:1891
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
- nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 above-water fastener selection 2:847*f*
 alloy 22 2:767, 3:1881*t*, 3:1887, 3:1888*f*; 3:1890*t*, 3:1891*f*
 alloy 686 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
 alloy 2000 2:1241*f*, 2:1247*f*; 3:1881*t*, 3:1889, 3:1890*t*, 3:1891*f*
 alloy C-4 1:145*f*; 3:1881*t*, 3:1887, 3:1888*f*; 3:1891*f*, 3:1900
 alloy C-276 1:145*f*; 2:849*f*, 2:1240*f*; 2:1243*f*, 3:1886
 alloy MAT 21 3:1881*t*, 3:1889
 below-water fastener selection 2:849*f*
 corrosion resistance 3:1886
 fireside corrosion 1:480*f*
 galvanic corrosion 2:1119*f*
 galvanic series 2:831*f*
 general discussion 3:1886
 historical development 3:1882*t*
 hydrochloric acid (HCl) corrosion 2:1215*f*; 2:1216*f*
 hydrofluoric acid (HF) corrosion 2:1214*f*
 intergranular corrosion 2:819
 major alloying elements 3:1881, 3:1881*t*
- nickel–chromium (Ni–Cr) alloys
 alumina scale formation 1:623*f*
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209*f*
 carburization kinetics 1:279*t*
 carburization rate variations 1:280*f*
 chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421*f*
 chromium carbide precipitation 1:277*t*
 coefficients of thermal expansion (CTEs) 1:632*f*
 corrosion resistance 3:1885, 3:1886*f*; 3:1900
 galvanic corrosion 2:1119*f*
 high temperature oxidation behavior 1:554*f*; 1:592, 1:593*t*
 historical development 3:1882*t*
 hydrofluoric acid (HF) corrosion 2:1214*f*
 internal carbides 1:277*t*
 internal nitridation processes 1:308–309, 1:309*f*
 major alloying elements 3:1881, 3:1881*t*
 mechanical properties 1:584
 minor alloying element addition effects 1:424*f*; 1:425*f*; 1:426*f*
 molybdenum additives 3:2159
 oxide overlay coatings 1:698*f*
 phase diagram 1:586*f*
 scale adhesion 1:627, 1:628*f*
 steam and steam/hydrogen environments 1:430, 1:431*f*; 1:432*f*
 sulfidation corrosion 1:247*f*
 time to breakaway 1:636*f*
 vanadium attacks 1:472*f*
- nickel–cobalt–aluminum–yttrium (NiCoAlY) alloys 4:2624–2625
- nickel–copper (Ni–Cu) alloys
 corrosion protection methods 2:1143
 corrosion resistance 3:1883
 erosion resistance 2:985*f*
 flow-induced corrosion 2:982*f*
 galvanic corrosion 2:831*f*; 2:854*t*, 2:1119*f*; 3:1845*f*
 historical development 3:1882*t*
 major alloying elements 3:1881, 3:1881*t*
 marine environments 2:1131, 2:1132*t*; 2:1133*f*; 2:1134*f*; 2:1135
 materials selection 2:982*f*
 metal dusting 1:296, 1:296*f*
 phase diagram 1:64*f*
 stress corrosion cracking (SCC) 2:867*t*
- nickel–iron–chromium (Ni–Fe–Cr) alloys
 carbide precipitation zones 1:281*f*
 carburization rate variations 1:280*f*
 cast refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:603*t*
 cathodic modification 3:2235
 coke deposition 1:292*f*
 galvanic corrosion 2:831*f*; 2:851*t*; 2:852*t*; 2:1119*f*
 global rating parameter (KB₄) 1:594, 1:596*f*
 high temperature oxidation behavior 1:552*f*; 1:593, 1:593*f*; 1:594*f*
 intergranular corrosion 2:819
 intragranular corrosion 2:1478
 metal dusting 1:291, 1:292*f*; 1:293*f*
 post-carburization appearance 1:282*f*
 sulfidation corrosion 1:250
 surface alloying processes 3:2240
 wrought refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:599*t*, 1:600*t*
- nickel–molybdenum (Ni–Mo) alloys
 corrosion resistance 3:1884, 3:1885*f*
 galvanic corrosion 2:851*t*
 historical development 3:1882*t*
 intergranular corrosion 2:819
 major alloying elements 3:1881, 3:1881*t*
 time–temperature–notch impact energy diagram 3:1885*f*
- nickel-resist cast irons
 acetic acid corrosion 3:1767*t*
 characteristics 3:1750
 corrosion rates 3:1753*t*; 3:1753*t*
 gaseous environments 3:1785*t*; 3:1786*t*
 hydrochloric acid (HCl) corrosion 3:1765*t*
 salt solution corrosion 3:1768*t*, 3:1769*t*
 seawater corrosion 2:1125, 2:1125*t*; 3:1760*f*; 3:1761*f*; 3:1762*t*, 3:1761*f*
- nickel silvers 3:1943, 3:1952*t*
- nickel–sulfur (Ni–S) alloys 1:242, 1:243*f*; 1:245*f*
- nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
- nitridation resistance 1:309*f*
 process equipment materials 4:3210*f*; 4:3211
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 scaling index 1:584*t*
 solid oxide fuel cells (SOFCs) 1:510, 1:511*f*; 1:512*f*
 stainless steels 2:1232–1233, 3:1809
 stress growth measurements 1:159*t*
- sulfuric acid (H₂SO₄)
 anodic polarization curves 2:1239*f*
 chloride contamination 2:1241*f*
 corrosion rates 2:1238, 2:1239*f*
 iron alloying influences 2:1240*f*
 oxidizing environments 2:1240*f*
 performance characteristics 2:1241, 2:1242*f*; 2:1242*t*, 2:1243*f*
 protection mechanisms 2:1238, 2:1239*f*
 sulfuric acid (H₂SO₄) isocorrosion diagram 2:1242*f*; 2:1243*f*
 velocity factors 2:1241*f*
- superalloys
 compositions 1:693*t*
 high-temperature oxidation 1:692, 1:693*f*
 molybdenum additives 3:2159
 welding processes 3:2461
- nickel aluminate (NiAl₂O₄) 1:182*t*
- nickel aluminides (NiAl/Ni₃Al)
 alumina scale formation 1:547*f*; 1:623*f*; 1:652*f*; 1:654*f*
 aluminide coatings 1:665, 1:665*f*; 3:2188
 characteristics 1:646
 chlorine-containing environments 1:661
 coefficients of thermal expansion (CTEs) 1:632*f*
 compositions 1:609*t*
 crystal structure 1:104, 1:648*f*
 dislocations 1:106–107
 internal oxidation 1:633
 microstructure 1:651
 outward grown diffusion coatings 4:2538, 4:2539*f*
 pack aluminizing process 4:2534, 4:2537*f*; 4:2538*f*
 parabolic rate constants 1:624*t*
 partial pressure effects 1:654
 phase diagram 1:649*f*; 4:2539*f*
 platinum aluminide coatings 4:2544, 4:2545*f*
 porosity 1:651
 reactive element additions 1:227*t*, 1:655
 reactive element-modified aluminides 4:2549
 scale adhesion 1:223
 scale properties 1:650
 sulfur-containing environments 1:660
 sulfur impurities 1:230, 1:231*f*; 1:654–655
 thermal expansion coefficients 1:145*f*
 water vapor effects 1:637, 1:638*f*; 1:654

- nickel (Ni) (*continued*)
- nickel anode plating 4:2586–2587, 4:2587f, 4:2588t
 - nickel chloride (NiCl₂) 1:329f, 1:403f, 1:479f
 - nickel chromate (NiCr₂O₄) 1:182t
 - nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys
 - alloy 20
 - corrosion resistance 3:1891
 - galvanic corrosion 2:831f, 2:1119f
 - historical development 3:1882t
 - hydrofluoric acid (HF) production 3:1907
 - major alloying elements 3:1881t
 - maximum depth of crevice attack 2:1128t
 - pitting resistance 3:1897t
 - sulfuric acid (H₂SO₄) environments 2:1238f
 - sulfuric acid (H₂SO₄) production and handling 3:1903
 - alloy 31
 - acetic acid production 3:1908
 - acrylic acid/acrylate ester production 3:1909
 - corrosion loss measurements 3:1894t, 3:1895t
 - corrosion rates 3:1905f, 3:1911f
 - corrosion resistance 3:1892, 3:1900
 - fine and specialty chemicals 3:1910
 - historical development 3:1882t
 - hydrochloric acid (HCl) isocorrosion diagram 3:1894f
 - major alloying elements 3:1881t
 - phosphoric acid (H₃PO₄) production 3:1905, 3:1906f
 - pitting potential 3:1895f
 - pitting resistance 3:1894f, 3:1897t, 3:1900, 3:1901t
 - pollution controls 3:1912
 - stability limits 3:1895f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 2:1237f, 3:1893f
 - sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904f, 3:1905f
 - tank transport studies 3:1912
 - alloy 33
 - alkali corrosion 2:1200f
 - caustic soda (NaOH) production 3:1902, 3:1902f
 - corrosion loss measurements 3:1896t, 3:1897t
 - corrosion resistance 3:1892, 3:1896f
 - historical development 3:1882t
 - major alloying elements 3:1881t
 - pitting resistance 3:1894f, 3:1897t
 - sulfuric acid (H₂SO₄) environments 2:1238f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1897f
 - sulfuric acid (H₂SO₄) production and handling 3:1903
 - alloy 825
 - alkali corrosion 2:1200f
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - hydrohalic acid corrosion 2:1217f, 2:1219f
 - major alloying elements 3:1881t
 - nuclear waste isolation 2:767
 - pitting resistance 3:1897t
 - sulfuric acid (H₂SO₄) environments 2:1238f, 2:1243f
 - sulfuric acid (H₂SO₄) production and handling 3:1903
 - vinyl chloride monomer (VCM) production 3:1908
 - alloy G-3
 - acrylic acid/acrylate ester production 3:1909
 - corrosion loss measurements 3:1894t
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - hydrofluoric acid (HF) production 3:1907
 - major alloying elements 3:1881t
 - alloy G-30
 - corrosion loss measurements 3:1896t
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - major alloying elements 3:1881t
 - sulfuric acid (H₂SO₄) environments 2:1238f
 - corrosion resistance 3:1891
 - historical development 3:1882t
 - laser surface alloying (LSA) 4:2631
 - major alloying elements 3:1881, 3:1881t
 - nickel–chromium–molybdenum (Ni–Cr–Mo) alloys
 - above-water fastener selection 2:847f
 - alloy 22
 - corrosion loss diagram 3:1888f
 - corrosion resistance 3:1887
 - hydrohalic acid corrosion 2:1217f, 2:1219f, 2:1220f
 - major alloying elements 3:1881t
 - nuclear waste isolation 2:767
 - thermal stability 3:1890t
 - time–temperature–sensitization diagram 3:1891f
 - alloy 59
 - acetic acid production 3:1908
 - corrosion loss diagram 3:1888f
 - corrosion rates 3:1889f, 3:1905f, 3:1911f
 - corrosion resistance 3:1887, 3:1900
 - fine and specialty chemicals 3:1910
 - hydrochloric acid (HCl) isocorrosion diagram 3:1888f
 - hydrofluoric acid (HF) production 3:1907
 - hydrohalic acid corrosion 2:1217f, 2:1219f
 - major alloying elements 3:1881t
 - methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 - phosphoric acid (H₃PO₄) production 3:1906f
 - pitting resistance 3:1894f
 - pollution controls 3:1912
 - sulfuric acid (H₂SO₄) isocorrosion diagram 3:1888f
 - sulfuric acid (H₂SO₄) production and handling 3:1903, 3:1904f, 3:1905f
 - tank transport studies 3:1912
 - thermal stability 3:1890t, 3:1891f
 - time–temperature–sensitization diagram 3:1891f
 - toluene di-isocyanate (TDI) 3:1909
 - vinyl chloride monomer (VCM) production 3:1908
 - alloy 625
 - acrylic acid/acrylate ester production 3:1909
 - alkali corrosion 2:1200f
 - corrosion loss diagram 3:1888f
 - corrosion rates 3:1889f
 - corrosion resistance 3:1890, 3:1899
 - galvanic corrosion 2:849f
 - hydrohalic acid corrosion 2:1217f, 2:1219f
 - major alloying elements 3:1881t
 - nuclear waste isolation 2:767
 - phosphoric acid (H₃PO₄) production 3:1905
 - pitting resistance 3:1894f, 3:1900
 - sulfuric acid (H₂SO₄) isocorrosion diagram 2:1243f
 - thermal expansion coefficients 1:145f
 - time–temperature–sensitization diagram 3:1891f
 - vinyl chloride monomer (VCM) production 3:1908
 - alloy 686
 - corrosion resistance 3:1889
 - hydrohalic acid corrosion 2:1217f, 2:1219f
 - major alloying elements 3:1881t
 - thermal stability 3:1890t, 3:1891f
 - time–temperature–sensitization diagram 3:1891f
 - alloy 2000
 - corrosion resistance 3:1889
 - hydrohalic acid corrosion 2:1218f, 2:1219f, 2:1220f
 - major alloying elements 3:1881t
 - sulfuric acid (H₂SO₄) environments 2:1241f, 2:1247f
 - thermal stability 3:1890t, 3:1891f
 - time–temperature–sensitization diagram 3:1891f
 - alloy C-4
 - corrosion loss diagram 3:1888f
 - corrosion resistance 3:1887, 3:1900
 - hydrohalic acid corrosion 2:1220f
 - major alloying elements 3:1881t
 - methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 - thermal expansion coefficients 1:145f
 - time–temperature–sensitization diagram 3:1891f
 - toluene di-isocyanate (TDI) 3:1909
 - alloy C-276
 - acetic acid production 3:1908
 - acrylic acid/acrylate ester production 3:1909
 - corrosion loss diagram 3:1888f
 - corrosion rates 3:1889f
 - corrosion resistance 3:1886, 3:1900
 - galvanic corrosion 2:849f
 - hydrofluoric acid (HF) production 3:1907
 - hydrohalic acid corrosion 2:1217f, 2:1219f, 2:1220f
 - major alloying elements 3:1881t

- methylene di-*para*-phenylene isocyanate (MDI) 3:1909
 phosphoric acid (H₃PO₄) production 3:1906f
 pitting resistance 3:1894f, 3:1900
 pollution controls 3:1912
 styrene production 3:1908
 sulfuric acid (H₂SO₄) environments 2:1238f, 2:1240f, 2:1243f
 sulfuric acid (H₂SO₄) isocorrosion diagram 3:1887f
 sulfuric acid (H₂SO₄) production and handling 3:1903
 thermal expansion coefficients 1:145f
 thermal stability 3:1890t
 time-temperature-sensitization diagram 3:1891f
 toluene di-isocyanate (TDI) 3:1909
 vinyl chloride monomer (VCM) production 3:1908
 alloy MAT 21 3:1881t, 3:1889
 below-water fastener selection 2:849f
 fireside corrosion 1:480f
 flow-induced corrosion 2:982f
 general discussion 3:1886
 historical development 3:1882t
 hydrochloric acid (HCl) corrosion 2:1215f, 2:1216f
 hydrofluoric acid (HF) corrosion 2:1214f
 intergranular corrosion 2:819
 major alloying elements 3:1881, 3:1881t
 materials selection 2:982f
 nickel-chromium (Ni-Cr) alloys
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209f
 carburization
 carburization kinetics 1:279t
 chromium carbide precipitation 1:277t
 internal carbides 1:277t
 rate variations 1:280f
 corrosion resistance 3:1885, 3:1886f, 3:1900
 historical development 3:1882t
 hydrofluoric acid (HF) corrosion 2:1214f
 internal nitridation processes 1:308-309, 1:309f
 major alloying elements 3:1881, 3:1881t
 oxide overlay coatings 1:698f
 scaling index 1:584t
 vanadium attacks 1:472f
 nickel-copper (Ni-Cu) alloys
 corrosion protection methods 2:1143
 corrosion resistance 3:1883
 erosion resistance 2:985f
 flow-induced corrosion 2:982f
 galvanic corrosion 2:831f, 2:854t, 2:1119f, 3:1845f
 historical development 3:1882t
 major alloying elements 3:1881, 3:1881t
 marine environments 2:1131, 2:1132t, 2:1133f, 2:1134f, 2:1135
 materials selection 2:982f
 metal dusting 1:296, 1:296f
 phase diagram 1:64f
 stress corrosion cracking (SCC) 2:867t
 nickel-molybdenum (Ni-Mo) alloys
 corrosion resistance 3:1884, 3:1885f
 galvanic corrosion 2:851t
 historical development 3:1882t
 intergranular corrosion 2:819
 laser surface alloying (LSA) 4:2631
 major alloying elements 3:1881, 3:1881t
 time-temperature-notch impact energy diagram 3:1885f
 nickel oxide (NiO)
 amorphous alloys 3:2197f
 crystal structure 1:104
 diffusion processes 1:124, 1:125f, 1:126f, 1:127
 dislocations 1:106-107
 Ellingham diagram 1:652f
 enamel frit compositions 3:2321t, 3:2331t
 equilibrium oxygen partial pressure 1:410f
 fracture toughness values 1:168t
 free energy 1:542f
 general discussion 1:197
 growth rate 1:199, 1:200f
 high-temperature oxidation 1:182t, 1:183f
 oxidation tendencies 1:389f
 oxide basicity 1:477f
 oxide solubility 1:476-477, 1:476f
 Pilling-Bedworth ratio (PBR) 1:146t, 1:160t
 point defects 1:113, 1:127
 Poisson ratios 1:170t
 scale failure strain measurements 1:167t
 solubility plot 1:320f, 1:321f
 stress curve growth-time plot 1:158f
 stress growth measurements 1:159t
 structural characteristics 1:197, 1:198f
 superheater deposit composition 1:464t
 surface fracture energies 1:170t
 transient stage oxidation 1:197
 transport processes 1:199
 nickel-phosphorus (Ni-P) alloys 3:2197-2198, 3:2198f
 nickel plating 4:3184t
 nickel titanium (NiTi) alloys 2:764, 2:1312-1313, 2:1314
 nickel-water system Pourbaix diagram 2:1201f
 nitric acid (HNO₃) solutions 2:1252t
 oxidation processes
 general discussion 1:197
 growth rate 1:199, 1:200f
 high-temperature oxidation 1:182t, 1:183f
 structural characteristics 1:197, 1:198f
 transient stage oxidation 1:197
 transport processes 1:199
 pitting corrosion 2:774t
 production processes 3:1862
 redox couples equilibrium potential values 1:26t
 stainless steels
 alloying elements 2:1232-1233, 3:1809
 grades
 chemical compositions 3:1810t, 3:1812t, 3:1825t, 3:1863t, 3:1874t
 seawater corrosion 3:1856t
 testing environments 3:1864t
 standard reduction potential 3:2074t
 sulfate-reducing bacteria (SRB) 2:1178
 sulfidation corrosion 1:246f
 surgical implants
 health effects 2:1310, 2:1310t
 historical background 2:1308
 zinc-nickel (Zn-Ni) coatings 4:3188t
 zirconium (Zr)-based bulk metallic glasses 3:2199
 Nimonic alloys
 coefficient of friction 1:380f
 'glaze' formation 1:379
 Incoloy 800HT counterfaces 1:364, 1:366f, 1:367f
 load effects 1:366, 1:368f, 1:371
 Nimonic alloys-Stellite 6 wear-affected surfaces study
 relevant element oxidation tendencies 1:389f
 scanning electron microscopy (SEM) 1:381f, 1:383
 scanning transmission electron microscopy (STEM)
 aluminum oxide segregation 1:387f
 'glaze' formation 1:382f, 1:383, 1:384f
 sliding wear comparisons 1:388f
 spectral data 1:392t
 wear effects 1:385f, 1:386f
 structural characteristics 1:387, 1:390f, 1:391f
 wear maps 1:393, 1:394f
 processing route effects 1:371
 silicon nitride (SiN/Si₃N₄) counterface 1:371, 1:372f
 sliding wear comparisons 1:371
 Stellite 6 counterface 1:366
 wear effects 1:366f, 1:367f, 1:369f, 1:370f, 1:372f
 weight change comparisons 1:380f
 niobium (Nb) 3:2135-2150
 alloys
 alumina-forming alloys 1:608t, 1:609t, 1:615f
 amorphous alloys 3:2193
 chromia-forming alloys 1:608t, 1:609t
 chromium-niobium (Cr-Nb) alloys 1:549-550, 1:550f, 1:589, 3:2198-2199, 3:2198f, 3:2199f, 3:2202
 compositions 1:246t
 heat-resisting alloys-carburization effects 1:284, 1:284f
 intermetallic alloys
 nickel aluminides (NiAl/Ni₃Al) 1:656
 niobium aluminides 1:660
 titanium aluminides (TiAl/Ti₃Al) 1:658
 mechanical properties 3:2137t, 3:2137
 nickel-based superalloys 1:693t

- niobium (Nb) (*continued*)
 stainless steels 3:1811
 Ti18Nb4Sn alloy 2:1314
 Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 titanium niobium (TiNb) alloys 2:1312–1313
 uranium–niobium (U–Nb) alloys 3:2182, 3:2182*r*
 applications 3:2139*t*, 3:2138
 corrosion processes
 anodic oxide films 3:2141, 3:2141*t*
 aqueous corrosive environments
 alkali corrosion 3:2146*t*, 3:2145
 aqueous salts 3:2147
 fluorine (F) 3:2144, 3:2146
 galvanic corrosion 3:2146
 hydrochloric acid (HCl) 3:2145*f*
 hydrogen embrittlement 3:2146
 mineral acids 3:2144
 sulfuric acid (H₂SO₄) 3:2145*f*
 corrosion behavior 3:2142
 gaseous environments
 halide-containing environments 3:2144
 hydride formation 3:2144
 nitridation 3:2144
 oxidation 3:2143
 liquid metals 3:2147
 organic compounds 3:2148
 passive films 3:2142
 diffusion coatings 4:2535*t*, 4:2536*t*
 economic considerations 3:2138
 electrochemistry
 hydride formation 3:2139, 3:2144
 potential–pH (Pourbaix) diagram 3:2140*f*
 thermodynamics 3:2139
 fabrication processes 3:2137
 historical background 3:2135
 industrial applications
 anodes 3:2148
 chemical process equipment 3:2148
 medical/*in vivo* applications 3:2148
 mechanical properties 3:2137*t*, 3:2137*t*, 3:2136
 niobium beryllide (NbBe₂) 3:2177
 niobium carbide (NbC) 1:275*t*
 niobium nitride (NbN) 1:308*f*
 niobium oxide (Nb₂O₃) 1:146*t*, 1:203, 1:204*f*, 3:2197*f*
 niobium oxide (NbO) 1:542*f*
 nitric acid (HNO₃)
 containment materials 2:1255
 corrosion reactions 2:1252
 nitridation processes 1:400
 environmental conditions 1:549
 occurrence 3:2136
 oxidation processes 1:203, 1:204*f*
 physical properties 3:2136, 3:2136*t*
 platinumized niobium anodes 4:2795, 4:2795*t*, 4:2813, 4:2814*t*
 production processes 3:2136
 stainless steels 3:1811
 Nitinol 2:764
 nitrile rubber (NBR) 3:2410–2411, 3:2412*t*, 3:2413*f*, 3:2416*t*, 3:2431
Nitrobacter spp. 2:1183
 nitroethane 3:2380*t*
 nitrogen (N)
 aluminum nitride (AlN) 3:2301
 nitridation processes
 computer simulation modelling 1:314*f*
 diffusion-controlled internal nitridation 1:306, 1:307*f*
 general discussion 1:314
 heat-resisting alloys 1:260
 iron- and nickel-based superalloys 1:310, 1:311*f*
 laser gas nitriding (LGS) 4:2632–2633
 mechanical/kinetic effects 1:311, 1:312*f*
 thermodynamic stability 1:308, 1:308*f*
 thermal expansion coefficients 1:145*f*
 ammonia (NH₃)
 aluminum coatings 4:2564*f*
 ammonia–nitric acid–sulfuric acid–water (NH₃–HNO₃–H₂SO₄–H₂O)
 systems 2:1058
 ammonia–nitric acid–water (NH₃–HNO₃–H₂O) systems 2:1058
 ammonium bisulfide (NH₄HS) 4:3221–3223
 ammonium chloride (NH₄Cl) 3:1769*t*, 4:2537*t*
 ammonium nitrate (NH₄NO₃) 3:1769*t*, 4:2883
 anodic protection 4:2874*t*
 ammonium nitrate (NH₄NO₃) 4:2883
 aqueous ammonia solutions 4:2884
 atmospheric gases 2:1053*t*, 2:1054
 coal plant ammonia absorber system 4:3140, 4:3141*f*
 combustion conditions 1:461*f*
 dry deposition rates 2:1073*t*
 environmental conditions 2:1082*t*
 flue gas composition 1:462*t*
 glass linings and coatings 3:2324*t*
 Henry's law coefficients for common gases 2:1056, 2:1056*t*
 nitridation processes 1:400
 process equipment risk management 4:3217*f*, 4:3219, 4:3220*f*, 4:3220*t*
 rain chemistry 2:1063*f*, 2:1064*t*
 steam boiler systems 4:2977, 4:2986
 sulfuric acid–ammonia–water (H₂SO₄–NH₃–H₂O) systems 2:1057, 2:1058*f*
 tin corrosivity 3:2073
 water chemistry 2:1096, 2:1098*t*
 atmospheric gases 2:1053*t*, 2:1054, 2:1054*t*
 boron nitride (BN)
 advanced technical ceramics
 comparative attack rates 3:2302*f*
 corrosion resistance 1:679, 3:2285
 cubic boron nitride (CBN) 3:2301
 hexagonal boron nitride (HBN) 3:2301
 hydrolysis processes 3:2301*f*
 material types 3:2301
 nitridation processes 1:308*f*
 calcium nitrite (CaNO₂) 4:2997
 cellulose nitrate 4:3331
 chromium nitride (CrN/Cr₂N)
 nitridation processes
 computer simulation modelling 1:314*f*
 diffusion-controlled internal nitridation 1:306, 1:307*f*
 general discussion 1:314
 heat-resisting alloys 1:260
 iron- and nickel-based superalloys 1:310, 1:311*f*
 thermodynamic stability 1:308, 1:308*f*
 flue gas composition 1:462*t*, 1:463*t*
 fuel chemistry 1:459, 1:459*t*, 1:461*f*
 high-temperature tribocorrosion 1:373
 iron nitride (Fe₄N)
 internal nitridation processes 1:260
 nitridation processes
 diffusion-controlled internal nitridation 1:306
 heat-resisting alloys 1:260
 thermodynamic stability 1:308, 1:308*f*
 lead nitrate (Pb(NO₃)₂) 3:2060*t*
 molecular nitrogen (N₂) 2:1053*t*
 molybdenum nitride (Mo₂N) 1:308*f*
 niobium nitride (NbN) 1:308*f*
 nitrate (NO₃) 2:1056*t*, 2:1063*f*, 2:1064*t*, 2:1082*t*
 nitric acid (HNO₃) 2:1250–1269
 acid pickling 4:2990, 4:2993*t*
 alumina ceramics 3:2290, 3:2291*t*, 3:2292*f*, 3:2302*f*
 aluminum alloys 3:1998, 3:1999*f*
 aluminum coatings 4:2564*f*
 ammonia–nitric acid–sulfuric acid–water (NH₃–HNO₃–H₂SO₄–H₂O)
 systems 2:1058
 ammonia–nitric acid–water (NH₃–HNO₃–H₂O) systems 2:1058
 amorphous alloys 3:2193
 applications 2:1250
 aqueous nitric acid (HNO₃) corrosivity
 base metals 2:1250
 concentration amount 2:1250
 noble metals 2:1250
 passive metals 2:1252, 2:1253*f*, 2:1263
 atmospheric gases 2:1054
 cast iron corrosion 3:1765, 3:1766*f*
 containment materials
 aluminum (Al) 2:1255, 2:1255*f*
 corrosion rates 2:1253*t*, 2:1256*f*
 general discussion 2:1252

- hafnium (Hf) 2:1255
 niobium (Nb) 2:1255
 stainless steels 2:1253, 2:1253*t*, 2:1254*f*, 2:1256*f*
 tantalum (Ta) 2:1255
 titanium/titanium alloys 2:1254, 2:1254*t*
 zirconium (Zr) 2:1255
- corrosion-influencing factors
 cold work 2:1260, 2:1260*f*
 dissolved oxidizing species 2:1261, 2:1262*f*, 2:1263*f*
 dissolved reducing species 2:1263, 2:1264*f*, 2:1265*t*
 heat transfer 2:1266
 ionizing radiation 2:1264, 2:1265*f*, 2:1266*f*
 liquor-line corrosion effects 2:1267
 nitrous acid gases 2:1260, 2:1261*f*
 passive metals 2:1263
 solution boiling 2:1265
 vapor regions 2:1267
 welds 2:1259, 2:1259*f*
- corrosion mechanisms
 corrosion fatigue 2:1258
 crevice corrosion 2:1257
 end grain corrosion 2:1256*f*, 2:1257, 2:1257*f*
 erosion 2:1258
 fretting corrosion 2:1258
 galvanic corrosion 2:1259
 intragranular corrosion 2:1255, 2:1256*f*
 passivity-transpassivity continuum 2:1255
 stress corrosion cracking (SCC) 2:1258
- corrosion test methods
 in-service corrosion rates 2:1267
 nickel-iron-chromium (Ni-Fe-Cr) alloys 2:1478
 nitric acid-hydrofluoric acid (HNO₃-HF) test 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
 ranking tests 2:1267
- corrosivity
 aqueous nitric acid (HNO₃) 2:1250
 pure nitric acid (HNO₃) 2:1250, 2:1252*t*
- dry deposition rates 2:1073*t*
 glass linings and coatings 3:2324*t*
 Henry's law coefficients for common gases 2:1056, 2:1056*t*
 inhibitors 4:2990
 ionizing radiation effects
 aqueous environments 2:1337
 atmospheric environments 2:1337
 stainless steel corrosion 2:1337
- lead corrosivity 3:2063
 nickel-chromium-iron-molybdenum-copper (Ni-Cr-Fe-Mo-Cu) alloys 3:1896*t*, 3:1897*t*
 nitric acid-hydrofluoric acid (HNO₃-HF) test 2:1479*t*, 2:1480*f*, 2:1480*t*, 2:1482
 noble metal corrosion resistance 3:2216*t*
 process equipment risk management 4:3217*f*
 stainless steels 3:1842
 tin passivation 3:2071
 wood degradation effects 3:2443-2444
 zirconium corrosivity 3:2119, 3:2122*f*, 3:2124*t*, 3:2131
- nitric oxide (NO) 1:462*t*, 2:1053*t*, 2:1054, 2:1054*t*, 2:1073*t*
 nitridation processes 1:304-315
- alloys
 basic concepts 1:260
 corrosion mechanisms 1:262
 environment-based alloy selection 1:549, 1:550*f*, 1:551*f*
 equipment concerns 1:260
 general discussion 1:267
 predictive modeling 1:261*f*, 1:262
 pressure effects 1:263*f*, 1:264*f*, 1:265*f*
 thermochemistry 1:262
 transition stages 1:265*f*
- alumina-forming alloys 1:549, 1:639
 computer simulation modelling 1:313, 1:313*f*, 1:314*f*
 environmental conditions 1:400, 1:549
 general discussion 1:314
 heat-resisting alloys
 basic concepts 1:260
 environment-based alloy selection 1:549, 1:550*f*, 1:551*f*
 iron- and nickel-based superalloys 1:310, 1:311*f*
 mechanical/kinetic effects 1:311, 1:312*f*
 protective measures 1:312
 internal nitridation attacks 1:304, 1:305*f*
 laser gas nitriding (LGS) 4:2632
 molybdenum nitride (Mo₂N) 3:2165
 niobium (Nb) 3:2144
 tantalum (Ta) 3:2144
 thermodynamics
 diffusion coefficients 1:307*t*
 diffusion-controlled internal nitridation 1:306, 1:306*f*, 1:307*f*, 1:308*f*
 internal-external nitridation transition 1:309, 1:310*f*
 nitrogen-containing gas atmospheres 1:305, 1:305*f*
 solvent surface protrusions 1:307*f*
 stability conditions 1:308, 1:308*f*
- nitriles 4:2992*t*
 nitrilotriacetic acid (NTA) 4:2981
 nitrogen dioxide (NO₂)
 atmospheric gases 2:1053*t*, 2:1054, 2:1054*t*
 dry deposition rates 2:1073*t*
 environmental conditions 2:1082*t*
 Henry's law coefficients for common gases 2:1056*t*
 steel corrosion 3:1715
 transport mechanisms 2:1067*f*
- nitrous acid
 corrosivity 2:1260, 2:1261*f*, 2:1337
 dry deposition rates 2:1073*t*
 nitrous oxide (N₂O) 2:1053*t*, 2:1054, 2:1067*f*
 pitting corrosion 2:774*t*
 process equipment risk management 4:3217*f*
 silico-carbonitrides 1:680
 silicon nitride (SiN/Si₃N₄)
 advanced technical ceramics
 comparative attack rates 2:3202*f*
 corrosion resistance 1:678, 3:2285
 hot corrosion 1:678-679
 material types 3:2299
 penetration time-temperature plot 1:679*f*
 reaction-bonded silicon nitrides 3:2300
 sintered silicon nitrides 3:2300
 high-temperature tribocorrosion 1:355*f*, 1:360*f*, 1:364*f*, 1:365*f*, 1:371, 1:372*f*
 nitridation processes 1:308*f*
 silicon carbide (SiC) bricks 3:2339, 3:2340*t*
- sodium nitrite (NaNO₂) 3:2331*t*
 solid oxide fuel cells (SOFCs) 1:497*t*
 stainless steels
 alloying elements 3:1810
 grades
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1863*t*, 3:1874*t*
 seawater corrosion 3:1856*t*
 testing environments 3:1864*t*
- tantalum nitride (TaN) 1:308*f*
 titanium nitride (TiN)
 ceramics 1:680
 coatings 2:1316, 2:1319, 4:2632
 corrosion resistance 1:680
 historical background 2:1308
 nitridation processes
 computer simulation modelling 1:314*f*
 diffusion-controlled internal nitridation 1:306
 general discussion 1:314
 internal nitridation processes 1:260, 1:309*f*, 1:310, 1:310*f*
 iron- and nickel-based superalloys 1:310, 1:311*f*
 laser gas nitriding (LGS) 4:2632
 mechanical/kinetic effects 1:311, 1:312*f*
 thermodynamic stability 1:308, 1:308*f*
 oral cavity environment 2:1312-1313
 thermal expansion coefficients 1:145*f*
 water chemistry 2:1096, 2:1098*t*, 4:2937-2938, 4:2939*t*
 zirconium nitride (ZrN) 1:308*f*
- Nitrosomonas* spp. 2:1183
 noble gases 2:1053*t*
 noble metals 3:2205-2223
 alumina-forming alloys 1:616, 1:617*f*, 1:631
 anhydrous hydrogen halide gases/hydrohalic acids 2:1223
 cathodic modification 3:2224-2249

- noble metals (*continued*)
- background information 3:2226
 - basic concepts
 - active-passive state 3:2227, 3:2228f
 - active state 3:2227, 3:2228f
 - general discussion 3:2227
 - passive state 3:2227, 3:2228f
 - transpassive state 3:2228, 3:2228f
 - chromium alloys 3:2241
 - chromium/chromium-based alloys
 - general discussion 3:2230
 - kinetic effects 3:2230
 - corrosion resistance 3:2241t
 - current research areas 3:2245
 - general discussion 3:2225, 3:2247
 - iron-40% chromium-platinum-group metals (Fe-40% Cr-PGM) system 3:2243
 - passivation processes 3:2225, 3:2226f
 - passive film growth and structure analysis 3:2242
 - process mechanisms 3:2229
 - quaternary/ternary iron-chromium (Fe-Cr) alloy systems 3:2244
 - Russian research 3:2242
 - schematic diagram 3:2227f
 - stainless steels
 - corrosion rates 3:2232t
 - duplex stainless steels 3:2237, 3:2238t, 3:2239f, 3:2241t
 - galvanic coupling 3:2237
 - iron-chromium (Fe-Cr) alloys 3:2231, 3:2235f
 - iron-chromium-molybdenum (Fe-Cr-Mo) alloys 3:2233, 3:2234t, 3:2241
 - iron-chromium-nickel-manganese (Fe-Cr-Ni-Mn) alloys 3:2236
 - iron-chromium-nickel-molybdenum (Fe-Cr-Ni-Mo) alloys 3:2236
 - nickel-iron-chromium (Ni-Fe-Cr) alloys 3:2235, 3:2240
 - surface alloying processes 3:2240, 3:2241t
 - surface alloying processes
 - chromium coatings 3:2239
 - electrochemical parameters 3:2241t
 - general discussion 3:2239
 - iron-chromium (Fe-Cr) alloys 3:2240
 - nickel-iron-chromium (Ni-Fe-Cr) alloys 3:2240
 - coating characteristics 4:2526
 - corrosion behavior
 - general discussion 3:2212
 - gold (Au)
 - anodic processes 3:2214
 - dealloying 3:2215
 - extraction processes 3:2214
 - nanoporous materials 3:2215
 - platinum-group metals
 - anodic processes 3:2215
 - cathodic processes/hydrogen evolution 3:2216, 3:2217t
 - corrosion resistance 3:2216t
 - exchange current densities 3:2217t
 - extraction processes 3:2216
 - secondary recovery 3:2216
 - silver (Ag)
 - anodic processes 3:2212
 - atmospheric corrosion 3:2213
 - tarnishing 3:2213
 - corrosion resistance
 - general discussion 3:2246
 - hydrochloric acid (HCl) 3:2246
 - sulfuric acid (H₂SO₄) 3:2246
 - high-temperature properties
 - gold (Au) 3:2217
 - platinum-group metals 3:2217, 3:2218t
 - silver (Ag) 3:2217
 - intermetallic alloys
 - alloyed aluminide coatings 1:665
 - nickel aluminides (NiAl/Ni₃Al) 1:656
 - oxidation processes 1:659
 - titanium aluminides (TiAl/Ti₃Al) 1:658-659
 - iron-40% chromium-platinum-group metals (Fe-40% Cr-PGM) system 3:2243
 - production background 3:2206
 - properties
 - dispersion strengthened alloys 3:2209
 - general discussion 3:2206
 - gold (Au) 3:2206, 3:2207t
 - platinum-group metals 3:2207t, 3:2208
 - platinum-iridium (Pt-Ir) alloys 3:2209
 - platinum-rhodium (Pt-Rh) alloys 3:2209
 - platinum-ruthenium (Pt-Ru) alloys 3:2209
 - silver (Ag) 3:2206, 3:2207t
 - quaternary/ternary iron-chromium (Fe-Cr) alloy systems 3:2244
 - redox couples equilibrium potential values 1:26t
 - selected applications
 - anodes
 - cathodic protection 3:2222
 - dimensionally stable anodes 3:2221
 - chemical process equipment
 - bursting discs 3:2218
 - linings 3:2218
 - spinnerets 3:2218
 - dental restorations 3:2220, 3:2220t
 - electrical contact materials 3:2221
 - high-temperature materials
 - furnace windings 3:2219
 - gas turbines 3:2220
 - metal joining 3:2219
 - molten glasses and salts 3:2219
 - temperature measurement 3:2220
 - medical sensing and electrodes 3:2221
 - supply/demand estimations 3:2207t
 - thermodynamic behavior
 - general discussion 3:2209
 - gold (Au) 3:2210, 3:2211f
 - platinum-group metals 3:2210, 3:2211f
 - silver (Ag) 3:2209, 3:2210f
 - nonbiocidal coatings 4:2692, 4:2692t
 - nonosmotic blistering 4:2732
 - nonthermal spraying techniques
 - air spraying 4:2610, 4:2638
 - electrostatic spray deposition (ESD) 4:2611, 4:2640
 - Normal (Gaussian) distribution statistical method 2:1550, 2:1550f, 2:1552f
 - North Sea 2:1109t
 - nuclear graphite
 - enhanced radiolytic oxidation 3:2281
 - radiation damage 3:2280
 - Nusselt number 2:1610
 - nylon 3:2379t, 3:2383, 3:2385t, 3:2388f
 - Nyquist plot of impedance data 1:325f, 2:1359, 2:1360f
- O**
- oak 2:1325t
 - obeche 2:1325t
 - octane 3:2380t
 - octanol 3:2380t
 - Oddy test 4:3313-3314
 - Office of Pipeline Safety (US) 4:3273
 - offshore drilling structures 4:2824f
 - Ohm's law 2:1343
 - Ohriner-Morall theory 1:281-282
 - oil and gas industry
 - acidic inhibitors 4:2994, 4:2994t
 - corrosion management 4:3230-3269
 - chemical injection systems
 - carbon dioxide (CO₂)/hydrogen sulfide (H₂S) content 4:3260
 - common treatments 4:3260
 - inhibitor residuals 4:3261
 - iron counts 4:3261
 - oxygen monitoring 4:3261
 - pH measurements 4:3261
 - temperature/pressure measurements 4:3260
 - chemical treatments 4:2900-2929
 - batch treatments 4:2907f, 4:2907
 - continuous treatments 4:2906f, 4:2905
 - corrosion inhibition 4:2908
 - corrosion reactions 4:2902f, 4:2901
 - data management strategies 4:2928f, 4:2927
 - emulsion cleaners 4:2905f, 4:2903
 - field applications 4:2905

- inhibition risk evaluation/mitigation monitoring 4:2926*t*, 4:2925
- inhibitors 4:2905*f*, 4:2903
- injection failures 4:2906*f*, 4:2906
- microbially-induced corrosion (MIC) 4:2922*f*, 4:2920
- pipelines 4:2902*f*
- program management strategies 4:2924*f*, 4:2925*t*, 4:2923
- scale inhibition/control 4:2916
- squeeze treatments 4:2907*f*, 4:2907–2908
- treating terminology 4:2903
- communication and management structure
 - audit/compliance reviews 4:3266
 - contractual structure 4:3265
 - corrosion management team 4:3264
 - key performance indicators (KPIs) 4:3266*t*, 4:3265
 - management of change (MoC) procedures 4:3265
 - ongoing improvement practices 4:3266
- corrosion inhibition
 - adsorption inhibition processes 4:2909*f*, 4:2910*f*, 4:2908
 - chemical treatments 4:2902*f*, 4:2903
 - general discussion 4:2908
 - inhibitor performance analysis 4:2910*f*, 4:2910
 - inhibitor testing 4:2911
- corrosion threat characteristics 4:3233, 4:3235*f*
- design guidelines
 - commissioning procedures 4:3255
 - data management systems 4:3255
 - documentation 4:3250
 - engineering considerations 4:3253
 - general discussion 4:3250
- documentation guidelines
 - cathodic protection (CP) systems 4:3253
 - chemical injection systems 4:3251
 - corrosion management philosophy 4:3251
 - material selection reports 4:3250, 4:3252*f*
- engineering considerations
 - corrosion allowances 4:3253
 - corrosion threat minimization 4:3253, 4:3254*f*
 - inaccessible pipework 4:3253
 - insulation 4:3254
 - pigging facilities 4:3254
- fabrication/construction guidelines
 - commissioning procedures 4:3256
 - integrity management systems 4:3256
 - quality assurance (QA)/quality control (QC) 4:3255
- Front End Engineering Design (FEED)
 - basic concepts 4:3243
 - corrosion risk analysis 4:3247, 4:3247*f*
 - data availability 4:3244
 - financial projections 4:3247*f*
 - installation and operational considerations 4:3248, 4:3250*f*
 - laboratory tests 4:3247
 - modeling approaches 4:3244, 4:3245*f*, 4:3246*f*
 - procurement considerations 4:3248
 - quality assurance (QA) practices 4:3248
 - risk matrices 4:3247, 4:3247*f*
- general discussion 4:3233, 4:3267
- industry drivers and changes 4:3238
- inhibitor testing
 - autoclave tests 4:2914
 - bubble tests 4:2911
 - compatibility tests 4:2915*f*, 4:2914
 - field deployment tests 4:2914
 - general discussion 4:2911
 - jet impingement tests 4:2914
 - persistency tests 4:2913*f*, 4:2913
 - rotating cylinder electrode (RCE)/flow loops tests 4:2912*f*, 4:2912
 - weld corrosion 4:2914*f*, 4:2915*f*, 4:2914
- inspection techniques 4:3160
- management process guidelines 4:3240, 4:3242*f*
- microbially-induced corrosion (MIC)
 - bacteria monitoring techniques/serial dilution 4:2922*f*, 4:2920
 - biocide application procedures 4:2922
 - biocide treatments 4:2922
 - corrosion effects 4:2922*f*, 4:2920
- mitigation approaches
 - pipelines 4:3236–3237
 - process plants 4:3238
 - subsurface environments 4:3236
- monitoring techniques
 - background information 4:3121, 4:3124
 - case studies 4:3138
 - economic factors 4:3136*t*
 - field signature method (FSM) 4:3131, 4:3132*f*, 4:3133*f*
 - general discussion 4:3135
 - survey response findings 4:3124*t*
- operations phase
 - chemical injection systems 4:3260
 - communication and management structure 4:3264
 - corrosion management strategy implementation 4:3257
 - data management systems 4:3261
 - direct assessment (DA) procedures 4:3263
 - external protection 4:3260
 - fitness-for-service (FFS) assessments 4:3264
 - inspection and monitoring activities 4:3259*f*, 4:3257
 - process condition changes 4:3262
 - risk-based inspection (RBI) 4:3263
- pipelines
 - components 4:3236
 - corrosion characteristics 4:3236
 - in-line inspection (ILI) 4:3157, 4:3301
 - pipeline inspections gauge (PIG) 4:3158
- process plants
 - components 4:3237
 - corrosion characteristics 4:3237
 - risk-based inspection (RBI) 4:3238–3239, 4:3263
- scale inhibition/control
 - chemical treatments 4:2917*t*, 4:2916
 - control mechanisms 4:2917
 - general discussion 4:2916
 - inhibitor material selection 4:2919
 - inhibitor treatments 4:2916
 - removal methods 4:2919
 - scale formation 4:2916*f*
 - scale prediction models 4:2919*f*, 4:2917
 - squeeze treatments 4:2921*f*, 4:2919
- subsurface environments
 - components 4:3235
 - corrosion characteristics 4:3235
- offshore drilling structures 4:2824*f*
- polymer matrix systems 3:2398, 3:2398*f*, 3:2399*f*, 3:2400*f*, 3:2401*f*
- stainless steels
 - artificial environments 3:1868
 - environmental conditions
 - carbon dioxide (CO₂) 3:1868
 - chloride concentration effects 3:1868
 - elemental sulfur 3:1868
 - hydrogen sulfide (H₂S) 3:1867
 - sweet/sour environments 3:1867
 - temperature effects 3:1868
 - galvanic corrosion 3:1868
 - general discussion 3:1867
 - metallurgical factors
 - austenitic stainless steels 3:1869
 - duplex stainless steels 3:1869
 - ferritic stainless steels 3:1869
 - general discussion 3:1869
 - martensitic stainless steels 3:1869
 - NACE standard MR0175 stress cracking corrosion test method 3:1870
 - offshore production conditions 3:1869
- oil-fired boiler corrosion 1:404
- oil-in-water emulsions 4:2905*f*, 4:2903
- oil products 1:459*t*, 1:464*t*, 1:465*f*, 4:2942–2943
- oil tankers 4:2683, 4:2684*f*
- OKSCALE Prediction Model 4:2918
- olefins 3:2424, 3:2425*f*
- oleic acid 3:1842
- open circuit potential (OCM)
 - beryllium (Be) 3:2169, 3:2173*f*
 - magnesium alloys 3:2032*f*
- operational amplifiers 2:1350, 2:1350*f*
- optical microscopy

- optical microscopy (*continued*)
 basic concepts 2:1407
 corrosion studies
 heat-affected zone (HAZ) 2:1406–1407, 2:1406f
 magnesium alloys 2:1408f
- oral cavity
 dental fixtures 2:1308
 environmental conditions 2:1312–1313
 galvanic lesions 2:1311
- orange peel/pock marks 4:2740
- organic acids
 aluminum alloys 3:1998–1999
 anodic protection 4:2882
 aqueous carbon dioxide (CO₂) corrosion 2:1285
 atmospheric gases 2:1055
 cast iron corrosion 3:1766, 3:1767t
 glass enamel corrosion 3:2073, 3:2326
 lead corrosion 3:2063
 molybdenum corrosion 3:2163
 stainless steels 3:1842, 3:1843f
 water chemistry 2:1099
 zirconium corrosivity 3:2125
- organic coatings 4:2643–2665
 application methods 4:2637–2642
 air-assisted airless spray application 4:2640
 air atomized spray application 4:2638
 airless spray application 4:2639
 applicator skill 4:2641
 brush application 4:2638
 dip coating 4:2641
 electrostatic spray application 4:2640
 environmental conditions 4:2641
 flow coating 4:2641
 fluidized bed coating 4:2641
 general discussion 4:2637, 4:2654
 heated spray application 4:2640
 high-volume low-pressure (HVLP) spraying techniques 4:2610, 4:2639
 roller application 4:2638
- automotive industry
 antichip coatings 4:3173
 anticorrosive waxes 4:3173
 general discussion 4:3171
 pretreatment guidelines 4:3171
 primers 4:3172
 seam sealants 4:3173
 surfacers 4:3173
 underbody protection 4:3173
- background information 4:2644
 characteristics 4:2646
 conductive paints 4:2792
 corrosion-protective coatings 4:2666–2677
 active metal-rich pigmentation 4:2646f, 4:2648
 aluminum alloys 3:2006
 anodic passivation
 basic pigments 4:2670
 general discussion 4:2670
 soluble pigments 4:2670
 barrier protection 4:2646f, 4:2647, 4:2648f
 basic concepts 4:2645, 4:2646f
 cathodic protection 4:2646f, 4:2648, 4:2758, 4:2758f
 general discussion 4:2647, 4:2666
 inhibitor release coatings 4:2646f, 4:2649
 iron and steel
 anodic reactions 4:2669
 cathodic reactions 4:2667
 oxygen diffusion 4:2668, 4:2668t
 rust formation 4:2667
 water diffusion 4:2668, 4:2668t
 magnesium alloys 3:2036
 multilayered coating system 4:2648f
 paint protection mechanisms
 anodic passivation 4:2670
 cathodic protection 4:2669
 resistance inhibition 4:2671
 performance predictions 4:2676
 resistance inhibition
 below-film electrolytes 4:2671
 electrolyte concentrations 4:2675
 film thickness 4:2675, 4:2675t
 general discussion 4:2671
 ionogenic materials 4:2671
 outside-film electrolytes 4:2672, 4:2673f, 4:2674f
 solvents 4:2676
 temperature effects 4:2675
 smart coatings 4:2650
- corrosion test methods
 coating behavior 2:1508
 coating evaluations
 abrasion tests 2:1511
 distensibility 2:1511
 general discussion 2:1510
 hardness 2:1511
 impact tests 2:1511
- exposure conditions
 field and plant tests 2:1510
 general discussion 2:1509
 laboratory tests 2:1509
 general discussion 2:1508
 laboratory tests
 adherence tests 2:1510
 electrochemical tests 2:1509
 exposure cabinets 2:1510
 general discussion 2:1509
 specimen preparation techniques 2:1509
- formulation process
 combinatorial methods 4:2661
 design process
 basic concepts 4:2655
 formulation flow chart 4:2660f
 production flow chart 4:2661f
 raw material selection 4:2655f, 4:2656f, 4:2657f, 4:2658f, 4:2659f
 formulation specifications 4:2659, 4:2663t
 general discussion 4:2646
 raw material selection 4:2655f, 4:2656f, 4:2657f, 4:2658f, 4:2659f
 volume effects
 basic concepts 4:2657
 component variations 4:2662f
 component volume–coarseness relationship plot 4:2662f
 critical pigment volume concentration (CPVC) 4:2657, 4:2662f, 4:2662t
 film permeability 4:2662f
 film resistance 4:2662f
 paint properties 4:2662t
 pigment volume concentration (PVC) 4:2657, 4:2662f, 4:2662t
 general discussion 4:2664
- hydrogen embrittlement 2:907
 organic biocides 2:1188, 4:2922
 organic polymers 4:2917t, 4:2916
- paints and organic coatings 4:2637–2642, 4:2643–2665, 4:2666–2677
 anodic passivation
 basic pigments 4:2670
 general discussion 4:2670
 soluble pigments 4:2670
- automotive industry
 antichip coatings 4:3173
 anticorrosive waxes 4:3173
 general discussion 4:3171
 pretreatment guidelines 4:3171
 primers 4:3172
 seam sealants 4:3173
 surfacers 4:3173
 underbody protection 4:3173
- conductive paints 4:2792
 corrosion inhibitors 4:2995, 4:2995t
 general discussion 4:2666
 iron and steel
 anodic reactions 4:2669
 cathodic reactions 4:2667
 oxygen diffusion 4:2668, 4:2668t
 rust formation 4:2667
 water diffusion 4:2668, 4:2668t
 liquid-applied coatings (paint) 4:2705, 4:2706f, 4:3283, 4:3283t
 organic polymers 4:2917t, 4:2916

- paint inspection procedures 4:2720–2727
 duties and requirements 4:2720
 general discussion 4:2727
 inspection considerations 4:2722
 quality control methods 4:2720
 training and certification 4:2722
 paint protection mechanisms
 anodic passivation 4:2670
 cathodic protection 4:2669
 resistance inhibition 4:2671
 performance predictions 4:2676
 pigments
 colored pigments 4:2653
 corrosion-resistant coatings 4:2995*r*, 4:2996
 general discussion 4:2652
 inert/extender pigments 4:2653
 inhibitive pigments 4:2652
 reactive metal pigments 4:2653
 pipeline corrosion management 4:3283, 4:3283*r*
 resistance inhibition
 below-film electrolytes 4:2671
 electrolyte concentrations 4:2675
 film thickness 4:2675, 4:2675*r*
 general discussion 4:2671
 ionogenic materials 4:2671
 outside-film electrolytes 4:2672, 4:2673*f*, 4:2674*f*
 solvents 4:2676
 temperature effects 4:2675
 primary components 4:2645*f*
 additives 4:2653
 general discussion 4:2645, 4:2650
 pigments
 colored pigments 4:2653
 general discussion 4:2652
 inert/extender pigments 4:2653
 inhibitive pigments 4:2652, 4:2995*t*, 4:2996
 reactive metal pigments 4:2653
 polymers
 acrylic polymers 4:2652
 alkyds 4:2652
 characteristics 4:2651
 epoxies 4:2651
 general discussion 4:2651
 polymer matrix systems 4:2652
 polyurethane/polyurea coatings 4:2652
 sol-gel materials 4:2652
 solvents/carrier fluids 4:2654
 testing procedures 4:2646, 4:2663
 wet adhesion 4:2655
 organic inhibitors 4:2489
 construction materials 4:2997–2998
 industrial heating and cooling systems 4:2966, 4:2966*f*
 mining industry 4:2994
 oil and gas industry 4:2917*t*, 4:2908, 4:2916
 potable water systems 4:2966
 organic solvents 1:98*f*
 Ormocer™ lacquer 4:3331
 osmium (Os)
 corrosion resistance 3:2216*r*
 exchange current density 3:2217*r*
 high-temperature properties 3:2217, 3:2218*r*
 properties 3:2207*t*, 3:2208
 supply/demand estimations 3:2207*t*
 thermodynamic behavior 3:2210
 osmotic blistering 4:2732
 outer Helmholtz plane (OHP) 1:21
 outward grown diffusion coatings 4:2538, 4:2539*f*
 over-spray 4:2639
 overspray 4:2740
 oxalic acid 3:1766, 3:1842, 3:1843*f*, 3:1998–1999, 3:2073, 4:2882
 oxidation 1:195–239
 alumina-forming alloys
 Auger depth profiles 1:216*f*
 cross-section image 1:221*f*
 diffusion rates 1:221, 1:222*f*
 general discussion 1:215
 isotope profiles 1:220*f*
 oxidation rates 1:218, 1:219*f*
 oxide growth mechanisms 1:219, 1:220*f*
 reactive elements 1:224
 scale adhesion 1:223, 1:223*f*
 scale development 1:216, 1:216*f*
 scale morphology 1:217*f*, 1:220*f*
 chromia-forming alloys
 carburization 1:551
 general discussion 1:211
 localized oxidation 1:212*f*
 oxidation rates 1:211, 1:212*f*
 oxide layer development 1:213, 1:213*f*, 1:215*f*
 reactive elements 1:224
 scale formation 1:182*t*, 1:183*f*, 1:213*f*
 scale morphology 1:212*f*, 1:213*f*, 1:214, 1:215*f*
 steam and steam/hydrogen environments
 chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421*f*
 chromia-forming iron- and nickel-based alloys 1:418
 commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422*f*, 1:423*f*
 minor alloying element addition effects 1:423, 1:424*f*, 1:425*f*, 1:426*f*
 process mechanisms 1:418
 spalling tendencies 1:419*f*
 surface morphologies 1:423*f*
 weight change comparisons 1:419*f*, 1:420*f*
 sulfidation 1:551–552, 1:552*f*
 transport properties 1:211
 cobalt/cobalt alloys 1:200, 3:1926
 corrosive environments 1:400
 general discussion 1:196, 1:232
 intermetallic alloys
 Ellingham diagram 1:652*f*
 general discussion 1:649
 iron aluminides (FeAl/Fe₃Al)
 alumina scale formation 1:654
 general discussion 1:650
 microstructure 1:651
 partial pressure effects 1:654
 porosity 1:651
 reactive element additions 1:227*t*, 1:655
 scale properties 1:650
 sulfur impurities 1:654–655
 water vapor effects 1:654
 nickel aluminides (NiAl/Ni₃Al)
 alumina scale formation 1:652*f*, 1:654*f*
 general discussion 1:650
 microstructure 1:651
 porosity 1:651
 reactive element additions 1:227*t*
 scale properties 1:650
 platinum aluminides 1:227*t*, 1:659
 titanium aluminides (TiAl/Ti₃Al)
 general discussion 1:656
 microstructure 1:657–658
 nitrogen influences 1:657
 pretreatment options 1:658
 reactive element additions 1:658, 1:659*f*
 scale properties 1:656, 1:656*f*
 water vapor effects 1:658
 iron (Fe)
 characteristics 1:201
 high-temperature oxidation 1:182*t*, 1:183*f*, 1:202*f*
 oxide cross-section 1:202*f*
 resistance factors 1:560, 1:561*f*, 1:562*f*
 scale formation 1:182*t*, 1:183*f*
 stability conditions 1:201*f*
 iron oxidation film evaluations 2:1380–1382, 2:1381*f*, 2:1382*f*
 lead electrochemistry 3:2058
 low-alloy steel 1:558–582
 alloying effects
 aluminum (Al) 1:566
 basic concepts 1:562, 1:563*f*, 1:564*f*
 carbon (C) 1:565
 cerium (Ce) 1:569
 chromium (Cr) 1:568, 1:568*f*
 copper (Cu) 1:569
 diffusion-controlled growth 1:564*f*

- oxidation (*continued*)
- manganese (Mn) 1:567
 - molybdenum (Mo) 1:569
 - nickel (Ni) 1:568
 - phosphorus (P) 1:568
 - silicon (Si) 1:566
 - sulfur (S) 1:567
 - commercial low-alloy steels 1:572, 1:573*f*
 - general discussion 1:558
 - governing factors 1:559, 1:560*f*
 - industrial environments
 - carbon monoxide/carbon dioxide (CO/CO₂) environments 1:578, 1:579*f*
 - chemical environments 1:577
 - combustion gas conditions 1:576
 - steam environments 1:573, 1:575*f*, 1:576*f*
 - iron oxidation 1:560, 1:561*f*, 1:562*f*
 - stress effects
 - general discussion 1:570
 - growth stresses 1:571, 1:571*f*
 - system-applied stresses 1:572
 - thermal stresses 1:572
 - marine environments 2:1113
 - micro arc oxidation (MAO) 3:2034
 - minor alloying elements
 - general discussion 1:224
 - nonmetallic impurities
 - general discussion 1:231
 - sulfur (S) 1:230, 1:231*f*
 - reactive elements
 - general discussion 1:224
 - growth rate changes 1:226, 1:227*t*
 - oxidation rate changes 1:227*t*
 - promoted selective oxidation 1:226
 - scale adhesion 1:228
 - structural characteristics 1:225*f*
 - molybdenum corrosivity 3:2164, 3:2164*t*
 - nickel (Ni)
 - general discussion 1:197
 - growth rate 1:199, 1:200*f*
 - high-temperature oxidation 1:182*t*, 1:183*f*
 - structural characteristics 1:197, 1:198*f*
 - transient stage oxidation 1:197
 - transport processes 1:199
 - niobium corrosivity 3:2143
 - oxidation rate constants 1:196*f*
 - oxidation–reduction potential (ORP)
 - all volatile treatment (oxidizing) (AVT(O)) 4:2978
 - all volatile treatment (reducing) (AVT(R)) 4:2977
 - plasma electrolytic oxidation (PEO) 2:950, 3:2034, 3:2035*f*, 3:2036*f*
 - refractory metals and alloys
 - general discussion 1:203
 - molybdenum (Mo) 1:204*f*, 1:205
 - niobium (Nb) 1:203, 1:204*f*
 - protective coatings 1:207
 - refractory alloys 1:206
 - tantalum (Ta) 1:203, 1:204*f*
 - tungsten (W) 1:204*f*, 1:205, 1:205*f*
 - rubber 3:2422, 3:2422*f*, 3:2423*f*
 - silica-forming alloys
 - general discussion 1:208
 - silicides 1:209, 1:210*f*
 - silicon-containing alloys 1:208, 1:208*f*
 - steam and steam/hydrogen environments **1:407–456**
 - argon–water vapor (Ar–H₂O) atmospheres 1:408, 1:410*f*, 1:412*f*
 - basic concepts 1:408
 - chromium/chromium-based alloys
 - chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421*f*
 - chromia-forming iron- and nickel-based alloys 1:418, 1:420*f*
 - commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422*f*, 1:423*f*
 - minor alloying element addition effects 1:423, 1:424*f*, 1:425*f*, 1:426*f*
 - oxidation processes 1:418
 - spalling tendencies 1:419*f*
 - surface morphologies 1:423*f*
 - weight change comparisons 1:419*f*, 1:420*f*
 - environmental conditions
 - breakaway oxidation mechanisms 1:428*f*, 1:430
 - external chromia scale formation 1:427, 1:429*f*
 - internal oxidation 1:427, 1:428*f*
 - nonprotective oxidation 1:426
 - ferritic and austenitic stainless steels
 - construction materials 1:432*t*
 - general discussion 1:431
 - inner scale formation 1:443*f*
 - long-term behavior 1:436, 1:437*f*, 1:438*f*, 1:439*f*
 - oxidation rates 1:440*f*, 1:441*f*, 1:442*f*
 - pressure effects 1:449, 1:450*f*
 - scale growth rate 1:445, 1:445*f*
 - scale morphology 1:447*f*, 1:448*f*, 1:449*f*, 1:450*f*
 - spalling tendencies 1:439*f*
 - steam oxidation mechanisms 1:433, 1:434*f*, 1:435*f*
 - temperature dependence effects 1:440, 1:440*f*, 1:441*f*, 1:442*f*, 1:443*f*, 1:445*f*
 - time-based mass change 1:446*f*
 - void and gap formation 1:435, 1:436*f*, 1:437*f*, 1:438*f*, 1:439*f*
 - weight change comparisons 1:433*f*, 1:442*f*, 1:444*f*
 - metallic high-temperature components
 - alumina-forming alloys and coatings 1:449
 - borderline alloys 1:426
 - chromium/chromium-based alloys 1:418
 - environmental conditions 1:426
 - ferritic and austenitic stainless steels 1:431
 - general discussion 1:416
 - nomenclature 1:417
 - protective scale-forming elements (PSEs) 1:416, 1:417*f*
 - nomenclature 1:408
 - oxide scale growth
 - lattice diffusion 1:415
 - molecular diffusion 1:415, 1:416*f*, 1:417*f*
 - oxidation rate–hydration enthalpy relationship 1:415*f*
 - surface reaction kinetics 1:413, 1:414*f*
 - thermodynamics
 - argon–water vapor (Ar–H₂O) atmospheres 1:410*f*, 1:412*f*
 - equilibrium oxygen partial pressure 1:409*f*, 1:410*f*, 1:412*f*
 - gas atmospheres 1:409, 1:409*f*, 1:410*f*
 - material testing considerations 1:411, 1:412*f*, 1:413*f*
 - solid oxide stability 1:409
 - temperature dependence effects 1:411*f*
 - volatile reaction products 1:409, 1:411*f*
 - synthetic elastomers 3:2415, 3:2416*t*
 - tantalum corrosivity 3:2143
 - tin corrosivity 3:2072
 - Wagner's theory of internal oxidation
 - alloy design requirements 1:543, 1:543*f*
 - chromium alloys 1:490
 - kinetics laws 1:137
 - nitridation processes 1:306, 1:306*f*
 - pure metal reactions 1:188, 1:189*f*
 - silicon carbide (SiC) 1:676–677, 1:676*f*
 - wood 3:2441
 - see also* high-temperature oxidation; oxide scale growth
 - oxidation–reduction potential (ORP)
 - all volatile treatment (oxidizing) (AVT(O)) 4:2978
 - all volatile treatment (reducing) (AVT(R)) 4:2977
 - oxide scale growth **1:101–131**
 - alumina (Al₂O₃) scale growth 148
 - analytical methods
 - corrosion analysis methodology 1:139, 1:141*f*
 - corrosion product characterizations 1:140, 1:142*f*, 1:143*f*
 - cyclic oxidation 1:141*f*
 - predictive modeling 1:142
 - surface preparation 1:139
 - two-stage oxidation experiments 1:140, 1:142*f*, 1:143*f*
 - background information 1:102
 - chromia (Cr₂O₃) scale growth 148, 1:413, 1:414*f*, 1:419, 1:421*f*
 - crystal defects
 - dislocations 1:104, 1:105*f*, 1:106*f*, 1:107*f*, 1:108*f*
 - general discussion 1:102
 - glide dislocation 1:107*f*
 - grain boundaries and interfaces 1:108, 1:108*f*, 1:109*f*

- kinks and jogs 1:104, 1:106f, 1:107f
- point defects
- alumina (Al_2O_3) 1:129
 - basic concepts 1:102
 - chromium oxide (Cr_2O_3) 1:129
 - cobalt oxide (CoO) 1:127
 - general discussion 1:127
 - interstitial sites 1:102–103
 - intrinsic defects 1:103, 1:104f
 - iron oxides 1:128
 - nickel oxide (NiO) 1:113, 1:127
 - schematic diagram 1:102f
 - thermal defects 1:103
 - surfaces 1:107, 1:107f
 - terrace–ledge–kink (TLK) surfaces 1:107, 1:107f
- diffusion laws
- binary systems 1:118
 - chemical diffusion 1:122
 - diffusion mechanisms 1:117
 - Fick's law 1:116
 - general discussion 1:116
 - grain boundary diffusion 1:137, 1:137f, 1:139f
 - interdiffusion 1:118
 - intrinsic diffusion 1:118
 - Kirkendall effect 1:118, 1:118f
 - lattice diffusion 1:117
 - multiphase systems 1:119
 - nonstoichiometric oxides 1:122
 - short-circuit diffusion 1:121, 1:121f, 1:122f, 1:137
 - ternary systems 1:120
- diffusion processes
- alumina (Al_2O_3) 1:129
 - basic concepts 1:123, 1:123f
 - chromium oxide (Cr_2O_3) 1:129
 - cobalt oxide (CoO) 1:127
 - general discussion 1:127
 - iron oxides 1:128
 - microstructure effects 1:124, 1:125f, 1:126f
 - nickel oxide (NiO) 1:124, 1:125f, 1:126f, 1:127
- gas turbines 1:526, 1:526f, 1:528f
- intrinsic oxide scale growth
- chromia (Cr_2O_3) scale growth 1:160f
 - experimental observations 1:155, 1:156f
 - mass change–time plot 1:156f
 - modeling methods 1:160
 - nickel oxide (NiO) 1:158f, 1:159r
 - parabolic stages 1:156f
 - Pilling–Bedworth ratio (PBR) 1:146t, 1:160, 1:160r
 - stress curve growth–time plot 1:158f
 - stress growth measurements 1:159r
 - wave formation 1:156f
- mass transport processes 1:130
- metals and alloys 1:180–194
- alloy reactions
- exclusive scale growth criteria 1:191, 1:191f
 - general discussion 1:190
 - internal oxidation 1:192
 - internal oxidation–external scale formation transition 1:193
 - thermodynamics 1:190
- general discussion 1:180, 1:193
- pure metal reactions
- dual-oxidant thermodynamic reactions 1:184
 - Ellingham diagram 1:183f
 - general discussion 1:181
 - metal oxide transport properties 1:187, 1:188f, 1:189f
 - phase stability diagram 1:184, 1:184f, 1:185f
 - scale formation kinetics 1:186
 - single-oxidant thermodynamic reactions 1:181, 1:182t, 1:183f
 - Wagner's theory of internal oxidation 1:188, 1:189f
- scale formation kinetics
- basic concepts 1:186
 - linear rate law 1:187
 - logarithmic rate law 1:187
 - parabolic rate law 1:186, 1:187f
- minor element influences 1:146
- parabolic rate constant plot 1:146f, 1:147f
- Pilling–Bedworth ratio (PBR) 1:146r
- point defects
- alumina (Al_2O_3) 1:129
 - basic concepts 1:102
 - chromium oxide (Cr_2O_3) 1:129
 - cobalt oxide (CoO) 1:127
 - electronic defects 1:112
 - extended defects 1:115
 - Frenkel disorders 1:111
 - general discussion 1:127
 - impurity effects 1:115
 - interstitial sites 1:102–103
 - intrinsic defect equilibria 1:114
 - intrinsic defects 1:103, 1:104f, 1:110f
 - ionic crystals 1:110
 - ionized point defects 1:112
 - iron oxides 1:128
 - Kröger–Vink notation 1:110, 1:111f, 1:111r
 - nickel oxide (NiO) 1:113, 1:127
 - nonstoichiometric oxides
 - n*-type oxides 1:114
 - point defect equilibria 1:113
 - p*-type oxides 1:113 - schematic diagram 1:102f
 - Schottky disorders 1:111
 - thermal defects 1:103
- reactive element effects
- general discussion 1:146
 - location detection 1:148
 - oxide scale adherence 1:148
 - oxide scale growth kinetics 1:147f, 1:148
 - oxide scale growth mechanisms 1:148
- spalling tendencies 1:144
- steam and steam/hydrogen environments
- chromia (Cr_2O_3) scale growth 1:413, 1:414f
 - surface reaction kinetics 1:413, 1:414f
- stress effects
- active oxidation conditions 1:162
 - dissolution/precipitation conditions 1:162
 - epitaxial stresses 1:161–162
 - general discussion 1:176
 - geometrically induced growth stresses 1:161, 1:161f
 - integrity effects 1:164
 - intrinsic growth 1:155
 - oxide composition changes 1:162
 - protective treatments 1:171
 - thermally induced scale changes 1:162
 - thermal expansion coefficients 1:145f
- oximes 4:2992t
- oxygen (O)
- argon–oxygen decarburization (AOD) 3:1882
 - atmospheric gases 2:1053t
 - body fluid levels 2:1311–1312, 2:1312t
 - combustion conditions 1:461f
 - flue gas composition 1:460t, 1:462t
 - fuel chemistry 1:459, 1:459r
 - hydrogen peroxide (H_2O_2)
 - atmospheric gases 2:1055
 - dry deposition rates 2:1073t
 - radiolytic yields 2:1332t
 - stainless steel corrosion 2:1334, 2:1335f
 - transport mechanisms 2:1067f
 - water radiolysis 2:1331
 - zirconium corrosivity 3:2124 - iron and steel corrosion 4:2668, 4:2668t
 - lead dioxide (PbO_2) 3:2060t, 3:2197f
 - lead oxide (PbO) 3:2060t, 3:2197f
 - marine environments 2:1110, 2:1110f
 - molecular oxygen (O_2) 2:1053t, 2:1067f
 - ozone (O_3) 2:1053t, 2:1054t, 2:1055, 2:1056, 2:1056t, 2:1073t, 2:1082t
 - sodium–iron–sulfur–oxygen (Na–Fe–S–O) phase diagram 1:320f
 - soil characteristics 2:1154
 - uranium compounds 3:2184f, 3:2187
 - vacuum–oxygen decarburization (VOD) 3:1882
 - water chemistry 2:1096, 2:1097t, 3:1753, 3:1755f, 4:2937–2938, 4:2939t
 - water radiolysis 2:1331, 2:1332t
 - see also* high-temperature oxidation
- ozone (O_3) 2:1053t, 2:1054t, 2:1055, 2:1056, 2:1056t, 2:1073t, 2:1082t

P

- Pacific Ocean 2:1109*t*
 packaging materials 3:2000, 4:2997
 painted metals
 paint removal methods 4:3335
 refinishing methods 4:3335, 4:3336*f*
 paints and organic coatings 4:2643–2665, 4:2666–2677
 anodic passivation
 basic pigments 4:2670
 general discussion 4:2670
 soluble pigments 4:2670
 application methods 4:2637–2642
 air-assisted airless spray application 4:2640
 air atomized spray application 4:2638
 airless spray application 4:2639
 applicator skill 4:2641
 brush application 4:2638
 dip coating 4:2641
 electrostatic spray application 4:2640
 environmental conditions 4:2641
 flow coating 4:2641
 fluidized bed coating 4:2641
 general discussion 4:2637, 4:2654
 heated spray application 4:2640
 high-volume low-pressure (HVLV) spraying techniques 4:2639
 roller application 4:2638
 automotive industry
 antichip coatings 4:3173
 anticorrosive waxes 4:3173
 general discussion 4:3171
 pretreatment guidelines 4:3171
 primers 4:3172
 seam sealants 4:3173
 surfacers 4:3173
 underbody protection 4:3173
 background information 4:2644
 characteristics 4:2646
 conductive paints 4:2792
 corrosion inhibitors 4:2995, 4:2995*t*
 corrosion-protective coatings
 active metal-rich pigmentation 4:2646*f*, 4:2648
 barrier protection 4:2646*f*, 4:2647, 4:2648*f*
 basic concepts 4:2645, 4:2646*f*
 cathodic protection 4:2646*f*, 4:2648
 general discussion 4:2647
 inhibitor release coatings 4:2646*f*, 4:2649
 multilayered coating system 4:2648*f*
 smart coatings 4:2650
 formulation process
 combinatorial methods 4:2661
 component volume–coarseness relationship plot 4:2662*f*
 critical pigment volume concentration (CPVC) 4:2657, 4:2662*f*, 4:2662*t*
 design process 4:2655, 4:2655*f*, 4:2656*f*, 4:2657*f*, 4:2658*f*, 4:2659*f*
 film permeability 4:2662*f*
 film resistance 4:2662*f*
 formulation flow chart 4:2660*f*
 formulation specifications 4:2659, 4:2663*t*
 general discussion 4:2646
 pigment volume concentration (PVC) 4:2657, 4:2662*f*, 4:2662*t*
 production flow chart 4:2661*f*
 raw material selection 4:2655*f*, 4:2656*f*, 4:2657*f*, 4:2658*f*, 4:2659*f*
 volume effects 4:2657, 4:2662*f*, 4:2662*t*
 general discussion 4:2664, 4:2666
 hydrogen embrittlement 2:907
 iron and steel
 anodic reactions 4:2669
 cathodic reactions 4:2667
 oxygen diffusion 4:2668, 4:2668*t*
 rust formation 4:2667
 water diffusion 4:2668, 4:2668*t*
 liquid-applied coatings (paint) 4:2705, 4:2706*f*, 4:3283, 4:3283*t*
 organic polymers 4:2917*t*, 4:2916
 paint inspection procedures 4:2720–2727
 duties and requirements 4:2720
 additional services 4:2721
 inspection levels 4:2720
 inspection records and reports 4:2721
 precontract inspections 4:2722
 general discussion 4:2727
 inspection considerations 4:2722
 ambient conditions 4:2726
 blast cleaning abrasives 4:2722
 BS EN ISO 8501 4:2723
 BS EN ISO 8502 4:2725
 BS EN ISO 8503 4:2724
 chemical cleanliness 4:2725
 liquid paints 4:2722
 paint application monitoring 4:2726
 post-application monitoring 4:2726
 surface preparation 4:2723
 surface profile 4:2724
 quality control methods 4:2720
 training and certification 4:2722
 paint protection mechanisms
 anodic passivation 4:2670
 cathodic protection 4:2669
 resistance inhibition 4:2671
 performance predictions 4:2676
 pigments
 colored pigments 4:2653
 corrosion-resistant coatings 4:2995*t*, 4:2996
 general discussion 4:2652
 inert/extender pigments 4:2653
 inhibitive pigments 4:2652
 reactive metal pigments 4:2653
 pipeline corrosion management 4:3283, 4:3283*t*
 polymers
 acrylic polymers 4:2652
 alkyds 4:2652
 characteristics 4:2651
 epoxies 4:2651
 general discussion 4:2651
 polymer matrix systems 4:2652
 polyurethane/polyurea coatings 4:2652
 sol–gel materials 4:2652
 primary components 4:2645*f*
 additives 4:2653
 general discussion 4:2645, 4:2650
 pigments 4:2652
 polymers 4:2651
 solvents/carrier fluids 4:2654
 resistance inhibition
 below-film electrolytes 4:2671
 electrolyte concentrations 4:2675
 film thickness 4:2675, 4:2675*t*
 general discussion 4:2671
 ionogenic materials 4:2671
 outside-film electrolytes 4:2672, 4:2673*f*, 4:2674*f*
 solvents 4:2676
 temperature effects 4:2675
 testing procedures 4:2646, 4:2663
 wet adhesion 4:2655
 palladium (Pd)
 alumina-forming alloys 1:616
 corrosion resistance 3:2216*t*
 exchange current density 3:2217*t*
 high-temperature properties 3:2217, 3:2218*t*
 intermetallic alloys 1:665
 laser surface alloying (LSA) 4:2632, 4:2632*t*
 potential–pH (Pourbaix) diagram 3:2212*f*
 properties 3:2207*t*, 3:2208
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2245
 supply/demand estimations 3:2207*t*
 thermal expansion coefficients 1:145*f*
 thermodynamic behavior 3:2210
 see also noble metals
 paper 3:2000
 paper industry 3:1865
 parabolic rate law 1:186, 1:187*f*
 Paraloid™ coatings 4:3328
 Parana pine 2:1325*t*
 parking structures 4:3204, 4:3205*f*
 Parkinson's disease 2:1310

- passive alloys
- cathodic modification 3:2224–2249
 - background information 3:2226
 - basic concepts
 - active–passive state 3:2227, 3:2228*f*
 - active state 3:2227, 3:2228*f*
 - general discussion 3:2227
 - passive state 3:2227, 3:2228*f*
 - transpassive state 3:2228, 3:2228*f*
 - chromium alloys 3:2241
 - chromium/chromium-based alloys
 - general discussion 3:2230
 - kinetic effects 3:2230
 - noble metal additions 3:2230
 - current research areas 3:2245
 - general discussion 3:2225, 3:2247
 - iron–40% chromium–platinum–group metals (Fe–40% Cr–PGM) system 3:2243
 - noble metal additions 3:2230, 3:2241*t*
 - passivation processes 3:2225, 3:2226*f*
 - passive film growth and structure analysis 3:2242
 - process mechanisms 3:2229
 - quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 - Russian research 3:2242
 - schematic diagram 3:2227*f*
 - stainless steels
 - corrosion rates 3:2232*t*
 - duplex stainless steels 3:2237, 3:2238*t*, 3:2239*f*, 3:2241*t*
 - galvanic coupling 3:2237
 - iron–chromium (Fe–Cr) alloys 3:2231, 3:2235*f*
 - iron–chromium–molybdenum (Fe–Cr–Mo) alloys 3:2233, 3:2234*t*, 3:2241
 - iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
 - iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
 - nickel–iron–chromium (Ni–Fe–Cr) alloys 3:2235, 3:2240
 - noble metal additions 3:2231
 - surface alloying processes 3:2240, 3:2241*t*
 - surface alloying processes
 - chromium coatings 3:2239
 - electrochemical parameters 3:2241*t*
 - general discussion 3:2239
 - iron–chromium (Fe–Cr) alloys 3:2240
 - nickel–iron–chromium (Ni–Fe–Cr) alloys 3:2240
 - electroplated coatings 4:2590
- passive films
- amorphous alloys 3:2194–2195, 3:2195*t*, 3:2196*f*
 - cobalt-based alloys 3:1923, 3:1924*f*, 3:1925*f*
 - compositions 2:746
 - electrochemical scanning tunnel microscopy (ECSTM) analyses 2:1436, 2:1437*f*
 - kinetic mechanisms 2:737
 - pitting corrosion
 - film breakdown mechanisms 2:735*f*, 2:747, 2:792
 - general discussion 2:792
 - ion penetration mechanisms 2:792
 - metastable pits 2:757, 2:793, 2:794*f*
 - point defect model 2:1641, 2:1642*f*, 2:1645*f*, 2:1646*f*
 - stainless steels 3:1822, 3:1822*f*
 - steel
 - nonoxide passive films 3:1706, 3:1706*f*
 - passive oxide films 3:1705
 - tin (Sn) 3:2071
- passivity 2:731–752
- alloys 2:744
 - anodic polarization curves 2:732*f*, 2:733*f*, 2:734*f*, 2:735, 2:735*f*
 - basic concepts
 - anodic polarization curves 2:732*f*, 2:733*f*, 2:734*f*
 - general discussion 2:731
 - chemical/electrochemical passivity 2:733*f*, 2:734*f*, 2:743
 - corrosion rate determination 2:734
 - film compositions 2:746
 - kinetic mechanisms 2:737
 - nonaqueous liquids 2:744
 - oxide film growth mechanisms 2:737
 - passivity breakdown 2:735*f*, 2:747, 2:1621, 3:1824
 - thermodynamics
 - basic concepts 2:740
 - potential–pH (Pourbaix) diagram 2:742*f*
 - pathogenic bacteria 4:2951, 4:2951*f*
 - patinas 4:3326, 4:3327*f*, 4:3328*f*
 - Pearson surveys 4:3286
 - peat 3:2087*t*, 4:2563*t*
 - Peclet number 2:961
 - peeling 4:2740
 - Pentarthrum* spp. 3:2445
 - pentylacetate 3:2380*r*
 - perchloric acid (HClO₄) 3:2216*r*
 - perfluoroalkoxy (PFA) 2:1246
 - perfluoroelastomers 2:1224
 - periclaso 3:2013*t*
 - perovskites 1:507, 1:510*f*, 1:511*f*
 - peroxide vulcanization 3:2436
 - petrochemical/chemical industries
 - industry characteristics 4:3208
 - process equipment
 - characteristics 4:3208, 4:3208*f*
 - failure incidents 4:3208–3209, 4:3209*f*
 - future trends 4:3226
 - general discussion 4:3227
 - microprocess equipment 4:3226, 4:3226*f*
 - operating conditions 4:3208, 4:3208*f*
 - protective treatments
 - coatings and linings 4:3212
 - electrochemical protection 4:3213
 - inhibitors 4:3213
 - selection guidelines 4:3213
 - risk management 4:3207–3229
 - environmental cracking 4:3214*f*
 - environmentally-assisted cracking 4:3217, 4:3217*f*, 4:3218*f*, 4:3219*f*, 4:3220*f*, 4:3220*r*
 - external corrosion risks 4:3215, 4:3216*f*
 - internal corrosion risks 4:3217, 4:3217*f*, 4:3218*f*, 4:3219*f*, 4:3220*f*, 4:3220*r*
 - materials selection 4:3210, 4:3210*f*, 4:3213
 - operation-based risk mitigation 4:3221, 4:3223*f*, 4:3224*f*
 - organic waste destruction 4:3225*f*
 - protective treatments 4:3212
 - risk-based cost benefit analysis 4:3223, 4:3225*f*
 - risk mitigation guidelines 4:3214
 - stress corrosion cracking (SCC) 4:3215*f*
 - supercritical water oxidation (SCWO) 4:3224–3226, 4:3225*f*
 - petrolatum tapes 4:2707
 - petroleum-derived bricks 2:1248, 3:2339, 3:2339*t*
 - petroleum industry *see* oil and gas industry
 - petroleum products 3:2000
 - Petrotech MultiSCALE Code 4:2918
 - pH
 - aerosols 2:1061
 - alkaline cleaners 4:2486*t*
 - aluminum alloys 3:1987*f*
 - aluminum coatings 4:2564, 4:2564*f*
 - aqueous carbon dioxide (CO₂) corrosion 2:1274*f*, 2:1281, 2:1282*f*
 - aqueous hydrogen sulfide (H₂S) corrosion 2:1287*f*
 - atmospheric conditions 2:1065, 2:1082*t*
 - beryllium (Be) corrosion
 - corrosion resistance 3:2171
 - galvanic effect–impurity relationships 3:2173, 3:2173*f*
 - body fluids 2:1311, 2:1312*f*
 - copper/copper alloys 3:1945, 3:1945*f*
 - hydrofluoric acid (HF) 2:1207–1208, 2:1208*f*
 - hydrohalic acids 2:1207–1208
 - industrial-use carbon 3:2276
 - lead (Pb) 3:2057*f*
 - magnesium alloy corrosion 3:2027*f*
 - microbially-induced corrosion (MIC) 2:1185
 - molybdenum (Mo) 3:2161, 3:2161*f*, 3:2162*f*
 - natural waters 2:1104
 - niobium (Nb) 3:2140*f*
 - paint protection mechanisms 4:2674, 4:2674*f*

- pH (*continued*)
- pitting corrosion 2:780, 2:781*f*, 2:788, 2:789*f*
 - potential-pH (Pourbaix) diagram
 - aluminum (Al) 1:31, 1:32*f*
 - aluminum alloys 3:1987*f*
 - aqueous corrosive environment models 2:1012, 2:1591, 2:1593*f*, 2:1596*f*
 - atmospheric conditions 2:1082, 2:1083*f*, 2:1084*f*
 - chemical equilibrium computations 2:1597, 2:1598*f*
 - cobalt (Co) 3:1923*f*
 - copper/copper alloys 3:1945, 3:1945*f*
 - electrochemical equilibrium
 - general discussion 1:28
 - pH and potential-dependent equilibrium 1:29, 1:29*f*
 - purely pH-dependent equilibrium 1:29, 1:29*f*
 - purely potential-dependent equilibrium 1:28, 1:29*f*
 - gold (Au) 1:30, 1:30*f*, 3:2211*f*
 - iron (Fe) 1:30-31, 1:31*f*, 3:1702, 3:1703*f*, 3:1706*f*, 4:2894*f*
 - lead (Pb)
 - lead sulfate (PbSO₄) system 3:2058*f*
 - lead-water (Pb-H₂O) system 3:2057*f*
 - magnesium alloys 3:2027*f*
 - metastability computations 2:1599, 2:1599*f*
 - molybdenum (Mo) 3:2161*f*, 3:2162*f*
 - Nernst equation 1:28
 - niobium (Nb) 3:2140*f*
 - palladium (Pd) 3:2212*f*
 - passivation 2:740, 2:742*f*
 - pitting corrosion 2:778*f*, 2:784, 2:785*f*
 - platinum (Pt) 3:2211*f*
 - silver (Ag) 3:2210*f*
 - sulfur (S) 3:1706*f*
 - tantalum (Ta) 3:2140*f*
 - tungsten (W) 3:2154*f*
 - uranium (U) 3:2183*f*, 3:2184*f*
 - zirconium (Zr) 3:2105*f*
 - rain chemistry 2:1064*t*
 - seawater 2:1110
 - steam boiler systems
 - all volatile treatment (AVT) 4:2985
 - boiler water treatment 4:2982, 4:2983*f*
 - condensate treatment 4:2986
 - feedwater treatment 4:2977
 - makeup water treatment 4:2973
 - sulfate-reducing bacteria (SRB) 2:1174
 - superheater deposit composition 1:464*t*
 - sweet corrosion 4:3292
 - tantalum (Ta) 3:2140*f*
 - tin (Sn) 3:2070, 3:2070*f*, 3:2073
 - titanium (Ti) 3:2045
 - tungsten (W) 3:2154*f*, 3:2155
 - vitreous silica 3:2316*f*
 - water chemistry 2:1098*t*, 4:2939, 4:2939*t*, 4:2940*t*, 4:2958
 - wood 2:1325*t*, 3:2443
 - zinc-aluminum (Zn-Al) alloy coatings 4:2557*f*
 - zinc corrosion rates 3:2081*f*, 3:2084-2085
 - zirconium (Zr) 3:2105, 3:2105*f*, 3:2119*t*, 3:2128, 3:2129*t*
 - phenol-formaldehyde plastics 3:2384, 3:2385*t*
 - phenolic resins 3:2342, 3:2342*t*
 - phenols 3:2000, 3:2380*t*
 - phosphophyllite 4:2497*t*, 4:2501
 - phosphorus (P)
 - alkaline cleaners 4:2486
 - amorphous alloys 3:2196, 3:2198*f*
 - anodic protection
 - phosphate compounds 4:2883
 - phosphoric acid (H₃PO₄) 4:2874*t*, 4:2881, 4:2882*f*
 - boiler water treatment
 - congruent phosphate treatment 4:2983
 - coordinated phosphate treatment 4:2982, 4:2983*f*
 - equilibrium phosphate treatment 4:2984, 4:2985*f*
 - residual phosphate treatment 4:2980, 4:2981*t*
 - calcium phosphate (Ca₁₀(OH)₂(PO₄)₆) 2:1102, 4:2942*t*
 - corrosion-resistant coatings 4:2995*t*
 - diffusion coatings 4:2548*t*
 - inhibitive pigments 4:2652
 - iron phosphate (FePO₄/Fe₃(PO₄)₂) 4:2495, 4:2497*t*, 4:2500*t*
 - lead phosphate (Pb₃(PO₄)₂) 3:2060*t*
 - low-alloy steels 1:568
 - magnesium alloys 3:2019*t*
 - magnesium phosphate (3Mg₃(PO₄)₂·Mg(OH)₂) 4:2942*t*
 - manganese phosphate (Mn₃(PO₄)₂) 4:2495, 4:2496*t*, 4:2497*t*, 4:2500*t*
 - nickel-phosphorus (Ni-P) alloys 3:2197-2198, 3:2198*f*
 - phosphate coatings 4:2494-2502
 - coating characteristics
 - analytical tests and results 4:2499*t*
 - coating types 4:2496, 4:2497*t*
 - composition 4:2498
 - heating effects 4:2498, 4:2498*f*
 - metal surface factors 4:2497
 - phosphate solution effects 4:2497
 - post-phosphating rinse treatments 4:2499
 - structure 4:2498
 - coating formation
 - accelerators 4:2496
 - deposition mechanisms 4:2495
 - evolving-gas compositions 4:2496*t*
 - coating processes 4:2500*t*
 - general discussion 4:2494
 - performance characteristics
 - coating weight 4:2501*t*
 - corrosion protection 4:2499
 - phosphophyllite-hopeite ratio 4:2501
 - testing procedures 4:2500
 - scale inhibition/control 4:2917*t*, 4:2916
 - steel coatings 4:2500*t*
 - phosphate compounds 4:2883
 - phosphoric acid (H₃PO₄)
 - acid pickling 4:2992-2993, 4:2992*t*, 4:2993*t*
 - aluminum alloys 3:1999*f*
 - aluminum coatings 4:2564*f*
 - anodic protection 4:2874*t*, 4:2881, 4:2882*f*
 - cast iron corrosion 3:1765, 3:1766*f*, 3:1767*t*
 - copper/copper alloys 3:1963
 - glasses 3:2313
 - nickel-chromium-iron-molybdenum-copper (Ni-Cr-Fe-Mo-Cu) alloys 3:1892, 3:1894*t*
 - noble metal corrosion resistance 3:2216*t*
 - production processes 3:1905, 3:1906*f*
 - stainless steels
 - corrosion rates 3:1841, 3:1841*f*, 3:1842*f*
 - stainless steel vessels 4:2887
 - stripping techniques 4:3320
 - zirconium corrosivity 3:2121, 3:2123*f*
 - phosphorus pentoxide (P₂O₅) 3:2119*t*
 - sodium phosphate (Na₃PO₄) 4:2938-2939
 - sodium-phosphate (Na₂PO₄) molar ratio
 - congruent phosphate treatment 4:2983
 - coordinated phosphate treatment 4:2983, 4:2983*f*
 - equilibrium phosphate treatment 4:2984, 4:2985*f*
 - tricalcium phosphate (Ca₃(PO₄)₂) 4:2942*t*
 - water chemistry 2:1098, 2:1098*t*, 4:2938, 4:2939*t*
 - zinc phosphate (ZnPO₄/Zn₃(PO₄)₂) 4:2495, 4:2496*t*, 4:2497*t*, 4:2500*t*, 4:2670
 - photoelectrochemistry 1:140
 - photoluminescence spectroscopy (PLS) 1:140
 - photolytic laser chemical vapor deposition 4:2629, 4:2629*f*
 - physical vapor deposition (PVD)
 - aluminum coatings and cladding 4:3184, 4:3188*t*
 - amorphous alloys 3:2192-2193
 - pickling methods
 - acid pickling
 - alloy steels 4:2489, 4:2992*t*
 - general discussion 4:2487
 - hydrogen embrittlement 2:907, 4:2489
 - millscale formation 4:2487
 - nonferrous metals 4:2491, 4:2491*t*
 - pickling inhibitors
 - basic concepts 4:2990
 - characteristics 4:2992*t*
 - hydrofluoric acid (HF) 4:2993*t*
 - inorganic inhibitors 4:2490
 - nitric acid (HNO₃) 4:2993*t*
 - organic inhibitors 4:2489, 4:2490*f*

- phosphoric acid (H₃PO₄) 4:2993*t*
- sulfuric acid (H₂SO₄) 4:2992*t*
- scale removal mechanisms 4:2488, 4:2488*f*, 4:2991, 4:2993*t*
- nickel alloys 3:1899
- surface preparation 4:2705
- pigments
 - organic coatings 4:2645*f*
 - anodic passivation
 - basic pigments 4:2670
 - general discussion 4:2670
 - soluble pigments 4:2670
 - colored pigments 4:2653
 - general discussion 4:2645, 4:2652
 - inert/extender pigments 4:2653
 - inhibitive pigments 4:2652, 4:2995*t*, 4:2996
 - reactive metal pigments 4:2653
 - pigment volume concentration (PVC)
 - basic concepts 4:2657
 - component variations 4:2662*f*
 - component volume–coarseness relationship plot 4:2662*f*
 - film permeability 4:2662*f*
 - film resistance 4:2662*f*
 - paint properties 4:2662*t*
- Pilling–Bedworth ratio (PBR) 1:146*t*, 1:160, 1:160*t*, 1:706
- pineapple juice 3:1773*t*
- pinholes 4:2741
- pipelines
 - alternating current (AC) corrosion 4:2836*f*
 - background information
 - distribution statistics 4:3273*t*
 - general discussion 4:3272
 - pipeline network schematic diagram 4:3272*f*
 - coatings
 - external corrosion prevention strategies
 - alternating current (AC) monitoring surveys 4:3286
 - coating failures 4:3284
 - coating requirements 4:3281
 - coating types 4:3283, 4:3283*t*
 - condition monitoring 4:3285
 - direct current voltage gradient (DCVG) surveys 4:3285
 - field joint coatings 4:3284
 - FBE-polypropylene
 - application frame 4:2713*f*
 - application methods 4:2715*f*
 - basic concepts 4:2713
 - coextruded sheet method 4:2714*f*
 - coextruded spiral tape 4:2715*f*
 - injection molding 4:2714*f*
 - plastic extrusion welding 4:2714*f*
 - field joint coatings
 - FBE-polypropylene 4:2713, 4:2714*f*
 - FBE powder coatings 4:2712, 4:2713*f*
 - general discussion 4:2711
 - liquid-applied field joint coatings 4:2711, 4:2712*f*
 - radiation cross-linked heat shrink sleeves 4:2712
 - internal corrosion prevention strategies 4:3296
 - line pipe coatings
 - coal tar and asphalt/bitumen enamels 4:2709, 4:2812*t*, 4:3283, 4:3283*t*
 - FBE powder coatings 4:2708*f*, 4:2709, 4:2812*t*, 4:2836*f*, 4:3283, 4:3283*t*
 - general discussion 4:2707
 - line pipe coating plant schematic diagram 4:2708*f*
 - polyolefin coatings 4:2708*f*, 4:2710, 4:2812*t*, 4:3283, 4:3283*t*
 - liquid-applied coatings (paint) 4:2705, 4:3283, 4:3283*t*
 - refurbishment methods 4:2716
 - resistance measurements 4:2821
 - thermal insulation 4:2715, 4:2716*f*
- corrosion management 4:3270
 - cathodic protection
 - basic concepts 4:3287
 - close interval potential surveys (CIPs) 4:3290
 - design criteria 4:3288
 - impressed current anodes 4:3288, 4:3288*f*
 - internal protection 4:2812*t*, 4:2826, 4:2827*f*
 - monitoring procedures 4:3289
 - sacrificial anodes 4:3287, 4:3287*f*
 - shielding criteria 4:3289
 - system criteria 4:3288, 4:3289*f*
- coatings
 - alternating current (AC) monitoring surveys 4:3286
 - coating failures 4:3284
 - coating requirements 4:3281
 - coating types 4:3283, 4:3283*t*
 - condition monitoring 4:3285
 - direct current voltage gradient (DCVG) surveys 4:3285
 - field joint coatings 4:3284
- components 4:3236
- direct assessments
 - external corrosion direct assessment (ECDA) 4:3304
 - general discussion 4:3303
 - internal corrosion direct assessment (ICDA) 4:3304
 - stress corrosion cracking direct assessment (SCCDA) 4:3304
- erosion corrosion 4:2902*f*
- external corrosion risks
 - alternating current (AC) corrosion 4:3281
 - cathodic protection 4:3287
 - coatings 4:3281
 - corrosion mechanisms 4:3236, 4:3277
 - direct assessment techniques 4:3304
 - microbially-induced corrosion (MIC) 4:3279
 - preferential corrosion 4:3280
 - prevention strategies 4:3281
 - risk assessment guidelines 4:3290, 4:3291*t*
 - soil corrosion 4:3278, 4:3278*f*
 - stray-current corrosion 4:3280, 4:3280*f*
- flow lines 4:3236
- in-line inspection (ILI)
 - advantages 4:3303
 - background information 4:3157
 - crack detection 4:3302
 - general discussion 4:3301
 - inspection vehicles 4:3158, 4:3159*t*
 - magnetic flux leakage (MFL) 4:3302
 - pipeline inspections gauge (PIG) 4:3158
 - ultrasonic wall thickness measurements 4:3302, 4:3302*f*
- inspection techniques
 - direct assessments 4:3303
 - general discussion 4:3301
 - hydrotests 4:3303
 - in-line inspection (ILI) 4:3157, 4:3301
 - management strategies 4:3160
- internal corrosion risks
 - carbon dioxide (CO₂) corrosion 4:3291
 - coatings 4:3296
 - corrosion allowance 4:3295
 - corrosion mechanisms 4:3236
 - corrosion-resistant alloys 4:3296
 - direct assessment techniques 4:3304
 - general discussion 4:3290
 - inhibitors 4:3296
 - localized corrosion 4:3293
 - microbially-induced corrosion (MIC) 4:3295
 - monitoring procedures 4:3297
 - prevention strategies 4:3295
 - product treatments 4:3296
 - risk assessment guidelines 4:3298, 4:3298*t*
 - sour corrosion 4:3294
 - sweet corrosion 4:3291
- localized corrosion
 - flow-induced localized corrosion (FILC) 4:3293
 - general discussion 4:3293
 - mesa corrosion 4:2902*f*, 4:3293
 - pitting corrosion 4:2902*f*, 4:3293
 - preferential weld corrosion 4:3293
- monitoring techniques 4:3144
- pipeline integrity management 4:3277, 4:3277*f*, 4:3305
- pitting corrosion 4:2902*f*
- prevention strategies
 - cathodic protection 4:2812*t*, 4:2826, 4:2827*f*, 4:3287
 - coatings 4:3281, 4:3283*t*, 4:3296
 - corrosion allowance 4:3295
 - corrosion-resistant alloys 4:3296
 - inhibitors 4:3296

- pipelines (*continued*)
- internal corrosion risks 4:3295
 - product treatments 4:3296
 - significance
 - cost concerns 4:3273
 - failure causes 4:3273, 4:3274*r*
 - pipeline age–spill frequency relationship 4:3275*f*
 - pipeline failure statistics 4:3273, 4:3274*r*
 - safety concerns 4:3276, 4:3276*t*
 - sour corrosion
 - erosion 4:2902*f*
 - general discussion 4:3294
 - hydrogen-induced cracking (HIC) 4:3294, 4:3295*f*
 - materials selection 4:3295
 - stress-oriented HIC 4:3295
 - sulfide stress corrosion cracking (SSCC) 4:3294
 - stress corrosion cracking (SCC) risks
 - characteristics 4:3299
 - direct assessment techniques 4:3304
 - external corrosion risks 4:3299
 - high-pH stress corrosion cracking 4:3299
 - near-neutral pH stress corrosion cracking 4:3300
 - occurrence 4:3299
 - risk assessment guidelines 4:3301
 - sweet corrosion
 - basic concepts 4:3291
 - flow rate effects 4:3292
 - hydrogen sulfide (H₂S) content effects 4:3293
 - partial pressure effects 4:3292
 - pH effects 4:3292
 - temperature effects 4:3292
 - field signature monitoring method (FSM) 4:3131, 4:3132*f*, 4:3133*f*
 - highly corrosive environments 3:1822*f*
 - lead corrosivity 3:2062
 - pipeline cathodic protection survey devices 4:2853, 4:2854*f*
 - protective treatments 2:1166
 - repair and maintenance options 4:3044, 4:3045*r*
 - soil corrosion 2:1152*f*, 2:1166
 - steel corrosion 3:1733
 - sulfate-reducing bacteria (SRB) 2:1174–1175, 2:1176, 2:1177*f*, 2:1178*f*
see also buried and ground-contact structures
- piperidine 3:2380*r*
- pit lining 3:2346
- pitting corrosion 2:772
- airframe corrosion 4:3177, 4:3178*r*, 4:3180*r*
 - alloying element influences 2:781, 2:782*f*
 - aluminum alloys
 - cathodic polarization curves 2:795*f*
 - characteristics 3:1986, 3:1988*f*
 - early stage corrosion 3:1991*f*
 - intergranular corrosion 2:795, 2:796*r*
 - marine environments 2:1138
 - pitting potentials 2:782*f*, 2:795, 2:796*r*
 - anodic protection 4:2863
 - automotive bodywork 4:3168
 - bulk solution composition effects
 - aggressive solutions 2:779, 2:779*f*
 - chloride concentration effects 2:780*r*
 - inhibitors 2:779, 2:780*r*
 - pH 2:780, 2:781*f*
 - sodium chloride (NaCl) effects 2:779*f*
 - carbon steel 2:1122–1123, 2:1122*f*, 2:1123*f*, 3:1711
 - characteristics 1:95*r*
 - cobalt-based alloys 3:1928
 - comparisons to crevice corrosion 2:757
 - copper/copper alloys
 - carbon film pitting 3:1955, 3:1955*f*
 - electrochemical processes 3:1955
 - freshwater environments 3:1954
 - hot soft water conditions 3:1955
 - marine environments 2:1133–1134
 - natural waters 3:1954
 - Type III pitting 3:1955
 - Type II pitting 3:1955
 - Type I pitting 3:1955, 3:1955*f*
 - corrosion management 4:3010
 - experimental observations
 - electrochemical parameters
 - general discussion 2:776
 - inhibition potential 2:778, 2:778*f*
 - pitting potentials 2:777, 2:777*f*, 2:779*f*
 - repassivation potential 2:778, 2:778*f*
 - pitting morphologies 2:775, 2:776*f*
 - fatigue models 2:938, 2:938*r*
 - industrial heating and cooling systems 4:2945, 4:2946*f*
 - inside-pit solutions
 - electrolytes 2:780
 - gas evolution 2:781
 - marine environments 2:1122–1123, 2:1122*f*, 2:1123*f*
 - nickel-based alloys 2:1135–1136
 - occurrence
 - chemical depassivation 2:774–775, 2:775*f*, 2:779, 2:780*r*
 - electrochemical depassivation 2:774
 - etch pits 2:775
 - general discussion 2:772
 - pitting-producing anions 2:774, 2:774*r*
 - schematic diagram 2:773*f*
 - passive film breakdown
 - film breakdown mechanisms 2:735*f*, 2:747, 2:792
 - general discussion 2:792
 - ion penetration mechanisms 2:792
 - metastable pits 2:757, 2:793, 2:794*f*
 - pipeline corrosion management 4:2902*f*, 4:3293
 - pitting nucleation sites 2:782
 - polarization curves 2:775*f*
 - potable water systems 4:2945, 4:2946*f*
 - stable pitting growth mechanisms
 - anodic and cathodic reactions 2:785*f*
 - basic concepts 2:783
 - buffer concentrations 2:789–790, 2:790*f*
 - experimental versus theoretical pitting potential values 2:793*r*
 - metal compound percentage calculations 2:787–788, 2:788*f*, 2:789*f*
 - migration effects 2:791, 2:791*f*
 - pH 2:788, 2:789*f*
 - potential–pH (Pourbaix) diagram 2:784, 2:785*f*
 - repassivation potential 2:790–791, 2:791*f*
 - size relationships 2:784*f*
 - sodium chloride (NaCl) effects 2:791*f*
 - transport processes 2:786, 2:787*f*, 2:788*f*
 - stainless steels
 - characteristics 3:1826, 3:1826*f*
 - crevice corrosion 2:759, 2:795, 2:796*f*, 2:796*r*, 2:1334–1335, 2:1336*f*
 - critical crevice corrosion temperature (CCT) 3:1850*f*
 - critical pitting temperature (CPT)
 - alloying additions 2:759
 - alloying element influences 3:1829*f*
 - basic concepts 2:797, 2:797*f*, 3:1827
 - grade resistance 3:1847, 3:1848*f*, 3:1849*f*
 - photographic illustration 3:1829*f*
 - potential dependence 3:1828*f*
 - diffusion restrictions 3:1826*f*
 - highly corrosive environments 3:1822*f*
 - marine environments 2:1125, 2:1131*r*
 - pit chemistry 2:749, 3:1826*f*
 - pitting potentials 3:1849*f*
 - sulfate-reducing bacteria (SRB) 2:1178
 - temperature effects 2:783, 2:783*f*
 - zirconium/zirconium alloys 3:2106, 3:2107*f*
 - planktonic microorganisms 2:1172
 - plasma-assisted vapor deposition (PAVD) 1:698
 - plasma electrolytic oxidation (PEO) 2:950, 3:2034, 3:2035*f*, 3:2036*f*, 4:2514–2515
 - plasma spraying
 - characteristics 4:2612*r*, 4:2614
 - high-pressure plasma spraying (HPPS) 4:2615
 - inert plasma spraying (IPS) 4:2615
 - low-pressure plasma spraying (LPPS) 4:2615
 - plasma-transferred arc (PTA) spraying 4:2615
 - radio frequency (RF) induction plasma spraying 4:2615
 - shrouded plasma spraying (SPS) 4:2614–2615
 - supersonic RF plasma spraying 4:2615
 - vacuum plasma spraying (VPS) 4:2615
 - plasma-transferred arc (PTA) spraying 4:2615
 - plasters 3:2000

- plastics **3:2369–2386**
 aluminum alloys **3:2000**
 amorphous thermoplastics
 acrylonitrile–styrene–butadiene polymers (ABS) **3:2382**
 cellulose-based plastics **3:2383**
 physical behavior **3:2373**
 plasticized amorphous thermoplastics **3:2374**
 polymethyl methacrylate (PMMA) **3:2379t, 3:2382**
 polystyrene **3:2382**
 polyvinyl acetate **3:2379t, 3:2382**
 polyvinyl chloride (PVC) **3:2382**
 rubber-modified amorphous plastics **3:2374**
 temperature–molecular weight phase diagram **3:2373f**
 background information **3:2370**
 chemical behavior
 free-radical addition polymerization **3:2371**
 ionic polymerization **3:2372**
 monomer molecules **3:2371**
 rearrangement polymerization **3:2372**
 step-growth polymerization **3:2372**
 chemical properties
 chemical attack resistance **3:2377**
 cracking resistance **3:2381**
 diffusion rates **3:2382**
 general discussion **3:2376**
 solubility
 amorphous nonpolar polymers/amorphous nonpolar solvents **3:2379, 3:2379t, 3:2380t**
 amorphous nonpolar polymers/crystalline solvents **3:2380**
 amorphous polar polymers/solvents **3:2380**
 crystalline nonpolar polymers/amorphous solvents **3:2379**
 crystalline polar polymers/solvents **3:2381**
 general discussion **3:2378**
 molecular compatibility **3:2378f**
 rubbers/thermosetting plastics **3:2381**
 solubility parameters **3:2379t, 3:2380t**
 commercial plastics
 amorphous thermoplastics
 acrylonitrile–styrene–butadiene polymers (ABS) **3:2382**
 cellulose-based plastics **3:2383**
 polymethyl methacrylate (PMMA) **3:2379t, 3:2382**
 polystyrene **3:2382**
 polyvinyl acetate **3:2379t, 3:2382**
 polyvinyl chloride (PVC) **3:2382**
 crystalline plastics
 fluorine-containing plastics **3:2383**
 linear polyesters **3:2383**
 polyamides (nylons) **3:2379t, 3:2383**
 polycarbonates **3:2384**
 polyethers **3:2383**
 polyethylene **3:2383**
 polyformaldehydes **3:2383**
 polyolefins **3:2377, 3:2383**
 polypropylene (PP) **3:2383**
 polysulfones **3:2384**
 polytetrafluoroethylene (PTFE) **3:2377, 3:2379t, 3:2383**
 thermosetting resins
 amino plastics **3:2384**
 epoxy resins **3:2384**
 furan resins **3:2341, 3:2342t, 3:2384**
 general discussion **3:2384**
 phenol–formaldehyde plastics **3:2384**
 polyurethanes **3:2384**
 silicones **3:2384**
 unsaturated polyesters **3:2384**
 definitions **3:2371**
 enhanced heat resistance **3:2384, 3:2385t**
 fiber reinforced plastics (FRPs) **2:1204, 3:2387–2406**
 above-water fastener selection **2:847f**
 accelerated ageing **3:2395**
 ageing effects
 chemical processing industry **3:2401**
 marine industry **3:2404**
 oil and gas industry **3:2398, 3:2398f, 3:2399f, 3:2400f, 3:2401f**
 supersonic flight **3:2396**
 ageing mechanisms
 chemical ageing **3:2393**
 fire resistance **3:2394**
 general discussion **3:2390**
 hygrothermal effects **3:2391**
 mechanical degradation **3:2394**
 physical ageing **3:2391**
 synergistic effects **3:2394**
 thermooxidative degradation **3:2392**
 time-dependent effects **3:2391**
 ultraviolet (UV) ageing **3:2393**
 weather degradation **3:2393**
 below-water fastener selection **2:849f**
 chemical processing industry
 Arrhenius relationship **3:2403**
 ASTM standard for long-term chemical resistance **3:2403**
 Barcol hardness changes **3:2403f**
 environmental conditions **3:2401**
 failures and defects **3:2402f**
 mass change–concentrated acid plot **3:2403f**
 scrubbing tower **3:2401f**
 semiempirical corrosion approach **3:2404**
 uniform corrosion **3:2402f**
 general discussion **3:2388, 3:2405**
 process equipment materials **4:3210, 4:3210f**
 strength comparisons **3:2388f**
 glass reinforced plastics **3:2388f, 3:2400f, 3:2401f**
 physical behavior
 basic concepts **3:2372, 3:2373f**
 reinforced plastics **3:2375**
 thermoplastic materials
 amorphous thermoplastics **3:2373, 3:2373f**
 crystalline thermoplastics **3:2374, 3:2375f**
 plasticized amorphous thermoplastics **3:2374**
 rubber-modified amorphous plastics **3:2374**
 thermosetting plastics **3:2375**
 polymer orientation **3:2376, 3:2376f**
 process equipment materials **4:3211, 4:3212f**
 reinforced plastics
 anhydrous hydrogen halide gases/hydrohalic acids **2:1223**
 physical behavior **3:2375**
 thermoplastic materials
 physical behavior
 amorphous thermoplastics **3:2373, 3:2373f**
 crystalline thermoplastics **3:2374, 3:2375f**
 plasticized amorphous thermoplastics **3:2374**
 rubber-modified amorphous plastics **3:2374**
 process equipment materials **4:3210, 4:3210f**
 rubbers **3:2385**
 thermosetting plastics
 alkali corrosion **2:1204**
 amino plastics **3:2384**
 anhydrous hydrogen halide gases/hydrohalic acids **2:1223**
 epoxy resins **3:2384**
 furan resins **3:2341, 3:2342t, 3:2384**
 general discussion **3:2384**
 phenol–formaldehyde plastics **3:2384**
 physical behavior **3:2375**
 polyurethanes **3:2384**
 silicones **3:2384**
 solubility **3:2381**
 unsaturated polyesters **3:2384**
 plastic settlement cracking **3:2358, 3:2358f**
 plastic shrinkage cracking **3:2358**
 plated coatings **4:2577–2609**
 corrosion protection methods **4:2578**
 electrodeposit properties
 coating thickness **4:2598**
 compositional effects **4:2601**
 current path geometry **4:2600**
 internal stress effects **4:2601, 4:2602f**
 mechanical properties **4:2602**
 porosity **4:2603, 4:2604f, 4:2605f**
 structure-dependent properties **4:2601**
 substrate–coating interdiffusion **4:2603**
 throwing power **4:2599, 4:2599f**
 historical background **4:2578**
 hydrogen embrittlement **2:907**
 ionic liquids **4:2605**

- plated coatings (*continued*)
- nonconductors
 - general discussion 4:2580
 - mechanical pretreatments 4:2580
 - plating methods
 - addition agents 4:2585
 - anodes 4:2586, 4:2587*f*, 4:2588*t*
 - aqueous electrolytes 4:2582, 4:2582*f*
 - cathode corrosion
 - agitation processes 4:2592
 - corrosion potential 4:2591, 4:2591*t*
 - general discussion 4:2588
 - high speed deposition 4:2591
 - passive alloys 4:2590
 - pulse plating 4:2592
 - service corrosion effects 4:2591
 - silver plating/strike baths 4:2589
 - zinc diecastings 4:2589, 4:2589*f*
 - complex ions 4:2584, 4:2585*f*
 - conducting salts 4:2585
 - cyanide ions 4:2584, 4:2585*f*, 4:2589
 - diffusion processes 4:2585*f*
 - electroplating 4:2581
 - industrial electroplating techniques 4:2597
 - plating baths 4:2585
 - postplating treatments 4:2598
 - rinsing processes 4:2597
 - simple ions 4:2584
 - structure-influencing factors
 - banding effects 4:2596*f*
 - current characteristics 4:2596
 - electrolyte effects 4:2595
 - epitaxy 4:2593, 4:2594*f*
 - pseudomorphism 4:2593, 4:2593*f*, 4:2595*f*
 - pretreatment options 4:2579
 - recent research developments 4:2606
 - substrates
 - banding effects 4:2596*f*
 - corrosion potential 4:2591, 4:2591*t*
 - electroplating 4:2581
 - epitaxy 4:2593, 4:2594*f*
 - general discussion 4:2578
 - pretreatment options
 - degreasing 4:2579
 - metallic substrates 4:2579
 - oxide removal/cleaning 4:2579
 - pseudomorphism 4:2593, 4:2593*f*, 4:2595*f*
 - plating methods
 - aircraft corrosion 4:3184*t*, 4:3188*t*
 - cadmium coatings 4:3184*t*, 4:3186, 4:3187*f*, 4:3194*t*
 - tin coatings 3:2074
 - platinum (Pt)
 - alumina-forming alloys 1:616, 1:617*f*, 1:631
 - anhydrous hydrogen halide gases/hydrohalic acids 2:1223, 2:1223*f*
 - anodic protection 4:2874*t*
 - coating characteristics 4:2526
 - corrosion resistance 3:2216*t*
 - crystal structure 1:55*t*
 - electroplated coatings 4:2584, 4:2587
 - exchange current density 3:2217*t*
 - galvanic corrosion 2:851*t*, 2:1119*f*
 - galvanic series 2:831*f*
 - high-temperature coatings 1:702
 - high-temperature properties 3:2217, 3:2218*t*
 - impressed current anodes
 - characteristics 4:2792
 - mixed metal oxide (MMO) anodes 4:2796, 4:2798
 - platinized niobium anodes 4:2795, 4:2795*t*, 4:2813, 4:2814*t*
 - platinized tantalum anodes 4:2795, 4:2795*t*, 4:2813
 - platinized titanium anodes 4:2792, 4:2795*t*, 4:2813, 4:2814*t*
 - intermetallic alloys
 - alloyed aluminate coatings 1:664–665, 1:665*f*
 - nickel aluminides (NiAl/Ni₃Al) 1:656
 - platinum aluminides 1:227*t*, 1:659, 4:2544, 4:2545*f*, 4:2546*f*, 4:2547*f*, 4:2549*f*
 - titanium aluminides (TiAl/Ti₃Al) 1:658–659
 - iron–40% chromium–platinum–group metals (Fe–40% Cr–PGM) system 3:2243
 - lead–platinum (Pb–Pt) bielectrodes 4:2787
 - nitric acid (HNO₃) solutions 2:1252*t*
 - platinum–group metals
 - corrosion behavior
 - anodic processes 3:2215
 - cathodic processes/hydrogen evolution 3:2216, 3:2217*t*
 - corrosion resistance 3:2216*t*
 - exchange current densities 3:2217*t*
 - extraction processes 3:2216
 - secondary recovery 3:2216
 - dispersion strengthened alloys 3:2209
 - high-temperature properties 3:2217, 3:2218*t*
 - platinum–iridium (Pt–Ir) alloys 3:2209
 - platinum–rhodium (Pt–Rh) alloys 3:2209
 - platinum–ruthenium (Pt–Ru) alloys 3:2209
 - potential–pH (Pourbaix) diagram 3:2211*f*, 3:2212*f*
 - production background 3:2206
 - properties 3:2207*t*, 3:2208
 - supply/demand estimations 3:2207*t*
 - thermodynamic behavior 3:2210, 3:2211*f*, 3:2212*f*
 - potential–pH (Pourbaix) diagram 3:2211*f*
 - properties 3:2207*t*, 3:2208
 - quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2245
 - thermal expansion coefficients 1:145*f*
 - thermodynamic behavior 3:2210, 3:2211*f*
 - see also* noble metals
 - plywood vats 3:2444
 - pock marks 4:2740
 - point defects
 - alumina (Al₂O₃) 1:129
 - basic concepts 1:102
 - chromium oxide (Cr₂O₃) 1:129
 - cobalt oxide (CoO) 1:127
 - electronic defects 1:112
 - extended defects 1:115
 - Frenkel disorders 1:111
 - general discussion 1:127
 - impurity effects 1:115
 - interstitial sites 1:102–103
 - intrinsic defect equilibria 1:114
 - intrinsic defects 1:103, 1:104*f*, 1:110*f*
 - ionic crystals 1:110
 - ionized point defects 1:112
 - iron oxides 1:128
 - Kröger–Vink notation 1:110, 1:111*f*, 1:111*t*
 - nickel oxide (NiO) 1:113, 1:127
 - nonstoichiometric oxides
 - n*-type oxides 1:114
 - point defect equilibria 1:113
 - p*-type oxides 1:113
 - predictive modeling 2:1641, 2:1642*f*, 2:1645*f*, 2:1646*f*
 - schematic diagram 1:102*f*
 - Schottky disorders 1:111
 - thermal defects 1:103
 - Poisson equation 2:1611–1613
 - Poisson process modeling 2:1553, 2:1576*t*
 - Poisson's ratio 1:78
 - polluted environments 3:1715, 3:1715*t*, 3:1716*t*
 - polyacetal 3:2385*t*
 - polyacrylic acid 3:1909, 4:2966
 - polyacrylic rubber (ACM)
 - applications 3:2412*t*
 - heat/oil resistance class 3:2413*f*
 - protective measures 3:2431
 - structure–property relationships 3:2416*t*
 - vulcanization systems 3:2436
 - polyacrylonitrile 3:2379*t*
 - polyamide–imide 3:2385*t*
 - polyamides (nylons) 3:2379*t*, 3:2383
 - polyaniline (PANI) 2:994, 2:994*f*, 2:995*f*
 - polyarylate 3:2385*t*
 - polybutadiene 3:2379*t*
 - polybutyl acrylate 3:2379*t*
 - polybutylene terephthalate 3:2385*t*
 - polybutyl methacrylate 3:2379*t*

- polycarbonates 3:2384
 polychloroprene rubber (CR)
 applications 3:2412*r*
 chemical structure 3:2415*f*
 glass-transition temperature (T_g) 3:2416*r*
 heat/oil resistance class 3:2413*f*
 oxidation and ozone resistance 3:2416*r*
 production mechanisms 3:2410–2411
 solubility parameters 3:2379*r*
 swelling resistance 3:2416*r*
 polychlorotrifluoroethylene 3:2379*r*
 polydimethyl siloxane 3:2379*r*
 polyepichlorohydrin rubber (CO) 3:2416*r*, 3:2436
 polyester resins 3:2342
 polyether ether ketone (PEEK) 3:2385*r*, 4:3212
 polyethers 3:2383
 polyether sulfone (PES) 3:2385*r*
 polyethyl acrylate 3:2379*r*
 polyethylene (PE)
 alkali corrosion 2:1204
 hydrohalic acid corrosion 2:1223–1224
 line pipe coatings 4:2708*f*, 4:2710, 4:2812*r*, 4:3283, 4:3283*r*
 process equipment materials 4:3212
 solubility parameters 3:2379*r*, 3:2385*r*
 sulfuric acid (H₂SO₄) environments 2:1246
 polyethylene terephthalate 3:2379*r*, 3:2385*r*
 polyethyl methacrylate 3:2379*r*
 polyformaldehydes 3:2383
 polyimides 3:2385*r*
 polyisobutylene 3:2379*r*
 polyisoprene 3:2379*r*
 polymers
 boiler water treatment 4:2982
 conductive polymers 4:2791
 controlled depletion polymers (CDPs) 4:2691–2692, 4:2692*r*
 intrinsically conducting polymers (ICPs) 2:994
 ionizing radiation effects 2:1337
 isocyanate-based polymers 4:2652
 organic coatings
 acrylic polymers 4:2652
 alkyds 4:2652
 characteristics 4:2651
 epoxies 4:2651
 general discussion 4:2651
 polymer matrix systems 4:2652
 polyurethane/polyurea coatings 4:2652
 sol-gel materials 4:2652
 organic polymers 4:2917*r*, 4:2916
 polymer matrix composites 3:2387–2406
 accelerated ageing 3:2395
 ageing effects
 chemical processing industry 3:2401
 marine industry 3:2404
 oil and gas industry 3:2398, 3:2398*f*, 3:2399*f*, 3:2400*f*,
 3:2401*f*
 supersonic flight 3:2396
 ageing mechanisms
 chemical ageing 3:2393
 fire resistance 3:2394
 general discussion 3:2390
 hygrothermal effects 3:2391
 mechanical degradation 3:2394
 physical ageing 3:2391
 synergistic effects 3:2394
 thermooxidative degradation 3:2392
 time-dependent effects 3:2391
 ultraviolet (UV) ageing 3:2393
 weather degradation 3:2393
 chemical processing industry
 Arrhenius relationship 3:2403
 ASTM standard for long-term chemical resistance
 3:2403
 Barcol hardness changes 3:2403*f*
 environmental conditions 3:2401
 failures and defects 3:2402*f*
 mass change-concentrated acid plot 3:2403*f*
 scrubbing tower 3:2401*f*
 semiempirical corrosion approach 3:2404
 uniform corrosion 3:2402*f*
 general discussion 3:2388, 3:2405
 organic coatings 4:2652
 strength comparisons 3:2388*f*
 self-polishing copolymers (SPCs) 4:2691–2692, 4:2692*r*
 polymethacrylate (PMA) 4:2966
 polymethyl methacrylate (PMMA) 3:2379*r*, 3:2382, 3:2385*r*
 polymethylphenyl siloxane 3:2379*r*
 polynomial regression models 2:1553
 polyolefin coatings 4:2708*f*, 4:2710, 4:2812*r*, 4:3283, 4:3283*r*
 polyolefins 3:2377, 3:2383
 polyphenylene oxide 3:2385*r*
 polyphenylene sulfide (PPS) 3:2385*r*
 polypropylene (PP)
 alkali corrosion 2:1204
 characteristics 3:2383
 FBE-polypropylene coatings
 application frame 4:2713*f*
 application methods 4:2715*f*
 basic concepts 4:2713
 coextruded sheet method 4:2714*f*
 coextruded spiral tape 4:2715*f*
 injection molding 4:2714*f*
 plastic extrusion welding 4:2714*f*
 hydrohalic acid corrosion 2:1223–1224
 process equipment materials 4:3211, 4:3212*f*
 solubility parameters 3:2379*r*, 3:2385*r*
 sulfuric acid (H₂SO₄) environments 2:1246
 vulcanization systems 3:2436
 polysiloxane coatings 4:2699, 4:2699*r*
 polystyrene 3:2379*r*, 3:2382, 3:2385*r*, 4:2668*r*
 polysulfide rubber (PTR) 3:2379*r*, 3:2412*r*
 polysulfones 3:2384, 3:2385*r*
 polytetrafluoroethylene (PTFE)
 chemical attack resistance 3:2377
 crevice corrosion 3:2107
 crystalline plastics 3:2383
 fluorocarbon membranes 3:2343, 3:2343*r*
 hydrohalic acid corrosion 2:1223–1224
 limiting oxygen index 3:2385*r*
 process equipment materials 4:3212
 solubility parameters 3:2379*r*
 sulfuric acid (H₂SO₄) environments 2:1246
 polyurethane coatings
 buried and ground-contact structures 4:2705, 4:2706*f*
 characteristics 4:2652
 field joint coatings 4:2711
 marine vessels 4:2698, 4:2698*r*, 4:2699*r*
 polyurethane rubber (AU, EU) 3:2412*r*, 3:2416*r*, 3:2431
 polyurethanes 3:2384
 polyvinyl acetate 3:2379*r*, 3:2382
 polyvinyl butyral (PVB) 2:989–991, 2:991*f*, 2:994*f*, 2:995*f*, 4:2668*r*
 polyvinyl chloride (PVC)
 alkali corrosion 2:1204
 characteristics 3:2382
 corrosive environments 1:402
 hydrohalic acid corrosion 2:1223–1224
 ionizing radiation effects 2:1337
 limiting oxygen index 3:2385*r*
 physical behavior 3:2374
 process equipment materials 4:3212
 solubility parameters 3:2379*r*
 sulfuric acid (H₂SO₄) environments 2:1246
 polyvinylidene chloride 3:2379*r*, 3:2385*r*
 polyvinylidene fluoride (PVDF) 2:1223–1224, 2:1246, 3:2343, 3:2343*r*,
 3:2385*r*, 4:3212
 porcelains
 chemically resistant bricks 3:2340
 comparative attack rates 3:2302*f*
 performance characteristics 3:2289
 porous implant materials 2:1315
 Portland cement
 chemical properties 3:2349, 3:2350*r*
 hydration processes
 basic concepts 3:2353
 silicates 3:2350

- Portland cement (*continued*)
 stages
 admixed chlorides 3:2352
 first stage 3:2351
 second stage 3:2352
 third stage 3:2352
 tetracalcium aluminoferrite (C₄AF) 3:2350*t*, 3:2351
 tricalcium aluminate (C₃A) 3:2350*t*, 3:2351
- potable water systems
 alkalinity 4:2939, 4:2939*t*, 4:2940*t*, 4:2953, 4:2958
 blistering 4:2958*f*
 chemical inhibitors
 cooling systems 4:2964, 4:2965*t*, 4:2968*f*
 general discussion 4:2961
 organic inhibitors 4:2966, 4:2966*f*
 steam boiler systems 4:2961
 water treatment 2:1104
 contaminant cycles of concentration (COC) 4:2959*t*, 4:2960, 4:2961*t*
 contaminant saturation conditions 4:2956
 corrosion mechanisms
 bacterial growth count evaluation 4:2969*t*
 concentrated cell/crevice corrosion 4:2947
 condensate line corrosion 4:2948
 erosion 4:2948
 galvanic corrosion 4:2946
 general discussion 4:2945
 grooving corrosion 4:2948
 impingement attacks 4:2948
 microbially-induced corrosion (MIC) 4:2949, 4:2949*f*, 4:2967, 4:2969*t*
 microbiological fouling 4:2950, 4:2950*f*, 4:2967, 4:2969*t*
 pathogenic bacteria 4:2951, 4:2951*f*
 pitting corrosion 4:2945, 4:2946*f*
 stress corrosion 4:2947
 uniform corrosion 4:2945
 white rust 4:2949
 corrosion mitigation 4:2933, 4:2936*f*
 corrosion rate quantification 4:2957*t*
 corrosion test coupon 4:2956*f*
 corrosion vulnerability data 4:2956*t*
 freshwater consumption 4:2932, 4:2935*f*
 hardness 2:1097, 4:2940–2941, 4:2953, 4:2958
 hydrologic cycle 4:2936, 4:2937*f*
 Langelier saturation index (LSI) 2:1100, 4:2958
 Larson–Skold index (L–SI) 4:2960
 makeup water treatment 4:2959*t*
 metal and alloy materials selection 4:2955, 4:2956*t*
 mineral scales, muds, and sludges
 chemical compositions 4:2942*t*
 closed-loop water systems 4:2943
 cooling systems 4:2943, 4:2943*f*
 general discussion 4:2941
 new-construction HVAC systems 4:2944
 potable water lines 4:2944
 steam boiler systems 4:2941, 4:2942*f*
 pretreatment processes 4:2953, 4:2954*f*
 Puckorius scaling index (PSI) 2:1100, 4:2959
 Ryznar stability index (RSI) 2:1100, 4:2959
 scale formation 4:2935, 4:2936*f*
 treatment guidelines 4:2952
 water chemistry 4:2936, 4:2939*t*
 water treatment factors 2:1104, 4:2933
- potassium (K)
 alumina ceramics 3:2290, 3:2291*t*, 3:2292*f*, 3:2302*f*
 chemically resistant membranes 3:2343
 dipotassium oxide (K₂O) 1:146*t*, 1:464*t*, 3:2308*t*, 3:2321*t*, 3:2331*t*
 fuel chemistry 1:459, 1:459*t*
 potassium aluminum sulfate (KAl(SO₄)₂·12H₂O) 3:1769*t*
 potassium carbonate (K₂CO₃) 1:465*f*, 3:2331*t*
 potassium chloride (KCl)
 paint protection mechanisms 4:2672, 4:2673*f*, 4:2674*f*
 phase diagram 1:531*f*
 reference electrodes 1:46, 1:47*f*
 vapor pressure–temperature plot 1:403*f*
 potassium cyanide (KCN) 3:2216*t*
 potassium hydrogen fluoride (KHF) 4:2537*t*
 potassium hydroxide (KOH) 3:2290, 3:2291*t*, 3:2292*f*, 3:2302*f*
 potassium sulfate (K₂SO₄) 1:465*f*, 1:477*f*, 1:478*f*, 1:531*f*
 rain chemistry 2:1064*t*
 seawater constituents 2:1109*t*
 zinc chloride (ZnCl₂)–potassium chloride (KCl) mixtures
 chromium chloride (CrCl₂) solubility 1:328*f*
 iron chloride (FeCl₂/FeCl₃) solubility 1:328*f*
 nickel chloride (NiCl₂) solubility 1:329*f*
 waste incineration corrosion 1:328, 1:328*f*
- potentiostat
 basic circuit 2:1350, 2:1350*f*
 basic concepts 2:1349
 configurations 2:1351, 2:1351*f*
 current control 2:1351, 2:1351*f*
 current measurements 2:1351, 2:1351*f*
 limitations 2:1352
 negative feedback circuit 2:1350, 2:1350*f*
 operational amplifiers 2:1350, 2:1350*f*
- Pourbaix diagram
 aluminum (Al) 1:31, 1:32*f*
 aluminum alloys 3:1987*f*
 aluminum–water system 2:1192*f*
 aqueous corrosive environment models 2:1012, 2:1591, 2:1593*f*,
 2:1596*f*
 atmospheric conditions 2:1082, 2:1083*f*, 2:1084*f*
 chemical equilibrium computations 2:1597, 2:1598*f*
 cobalt (Co) 3:1923*f*
 copper/copper alloys 3:1945, 3:1945*f*
 electrochemical equilibrium
 general discussion 1:28
 pH and potential-dependent equilibrium 1:29, 1:29*f*
 purely pH-dependent equilibrium 1:29, 1:29*f*
 purely potential-dependent equilibrium 1:28, 1:29*f*
 gold (Au) 1:30, 1:30*f*, 3:2211*f*
 iron (Fe) 1:30–31, 1:31*f*, 3:1702, 3:1703*f*, 3:1706*f*, 4:2894*f*
 iron–water system 2:1193*f*
 lead (Pb)
 lead sulfate (PbSO₄) system 3:2058*f*
 lead–water (Pb–H₂O) system 3:2057*f*
 magnesium alloys 3:2027*f*
 metastability computations 2:1599, 2:1599*f*
 molybdenum (Mo) 3:2161*f*, 3:2162*f*
 Nernst equation 1:28
 nickel–water system 2:1201*f*
 niobium (Nb) 3:2140*f*
 palladium (Pd) 3:2212*f*
 passivation 2:742*f*
 pitting corrosion 2:778*f*, 2:784, 2:785*f*
 platinum (Pt) 3:2211*f*
 silver (Ag) 3:2210*f*
 sulfur (S) 3:1706*f*
 tantalum (Ta) 3:2140*f*
 tungsten (W) 3:2154*f*
 uranium (U) 3:2183*f*, 3:2184*f*
 zirconium (Zr) 3:2105*f*
- powder-post beetles 3:2445
 power law 1:136
 pozzolanic materials
 background information 3:2354
 corrosion inhibitors 4:2997
 ground granulated blast furnace slag (GGBS) 3:2354
 inert fillers 3:2355
 pulverized fuel ash (PFA) 3:2354
 silica fume 3:2354
- Prandtl number 2:1610
 Prandtl's flow boundary layer calculation 1:682–683, 2:960–961
 praseodymium (Pr) 3:2014–2015
 precious metals 1:616, 4:2526, 4:2526*f*, 4:2527*f*
 see also noble metals; platinum (Pt)
- precipitation hardenable stainless steels
 compositional ranges 3:1808*t*
 intergranular corrosion 2:819
 marine corrosion 2:1125
 process equipment materials 4:3210–3211
 preferential corrosion 4:3280
 preferential weld corrosion 4:3293
 pressure die casting techniques 3:2021
 pressure-sensitive tapes 4:2707
 pressurized water reactors (PWRs)

- corrosion effects 2:1333, 2:1333f
 crevice corrosion 2:766
- propanol 3:2380r
- propene (C₃H₆) 2:1067f
- propionic acid 2:1324
- propylene 3:2371
- protective barrier inducement (PBI)
 aqueous acidic solutions 4:2895, 4:2896f, 4:2897f
 aqueous near-neutral solutions 4:2897, 4:2898f, 4:2899f
 basic concepts 4:2894
- proteins 4:2490
- Pseudomonas* spp. 2:1179, 4:2949, 4:2920
- Puckorius scaling index (PSI) 2:1100, 4:2959
- pulp and paper industry 3:1865, 4:3143
- pulsed laser deposition (PLD) 4:2628, 4:2628f, 4:2633r
- pulverized fuel ash (PFA) 3:2354
- pyridine 3:2380r
- pyrite (FeS₂) 1:320f, 2:1288
- pyrolytic graphite 3:2273, 3:2275r
- pyrrhotite 2:1288, 2:1288r, 2:1289f
- Q**
- quadratic regression models 2:1553
- qualitative risk-based inspections 4:3087
- quantitative risk-based inspections 4:3088, 4:3089f
- Quinn's oxidation wear model 1:345, 1:346f
- quinolines 4:2992r
- quinonedioximes vulcanization 3:2437
- R**
- radiation cross-linked heat shrink sleeves 4:2712
- radio frequency (RF) induction plasma spraying 4:2615
- radiolysis-induced environments 2:1330–1340
 corrosion effects
 aqueous environments
 chemical plant heating/cooling waters 2:1334
 general discussion 2:1332
 light water reactors (LWRs) 2:1333, 2:1333f
 nitric acid solutions 2:1264, 2:1265f, 2:1266f, 2:1337
 polymer degradation materials 2:1337
 stainless steel corrosion 2:1334, 2:1334r, 2:1335f, 2:1336f
 atmospheric environments 2:1337
 general discussion 2:1331
 test considerations 2:1338
 water radiolysis 2:1331, 2:1332r
- Rahmel–Tobolski mechanism 1:416, 1:416f
- rainfall
 acid rain 2:1062, 2:1064r
 aerosol transport mechanisms 2:1067
 atmospheric conditions 2:1082r
 deposition processes 2:1069
 rain chemistry 2:1062, 2:1063f, 2:1064r
 rain damage/water spotting 4:2741, 4:2744
 surface cleaning 2:1075, 2:1076f, 2:1077
 surface moisture 2:1077
- Raman spectroscopy 1:140, 1:162–163, 1:163f, 2:1427, 2:1428f, 3:2071
- Ramberg–Osgood equation 1:81, 1:81f
- ramin 2:1325r
- Randles equivalent circuit 2:1359f
- Raoult's law 2:725–726
- Rapp–Goto corrosion criterion 1:322, 1:322f, 1:323f
- rare earth magnets 2:1310, 2:1316
- rare earth materials
 alloy compositions 1:246r
 alloying element influences 1:546, 1:546f, 1:547f
 magnesium alloys 3:2014–2015, 3:2019r
 oxidation processes 1:224, 1:489
- rayon production 3:2130
- reaction-bonded silicon carbides 3:2297
- reaction-bonded silicon nitrides 3:2300
- reactive flame spraying (RFS) 4:2613
- reactive metal pigments 4:2653
- reactor coolants 3:2066
- rectifier voltage determinations 4:2820
- Red Sea 2:1109r
- red shale bricks 3:2338, 3:2338r
- refractory materials 1:668–690
 chemical dissolution 1:681
 chemically resistant bricks 3:2340
 cobalt-based alloys 3:1918, 3:1918r
 definition 1:670
 erosion 1:681
 general discussion 1:681, 1:688
 mechanical wear 1:681
 oxidation processes 1:203, 1:204f
 process equipment materials 4:3210f, 4:3211, 4:3211f
 zirconia (ZrO₂) 1:674
- reinforced plastics
 anhydrous hydrogen halide gases/hydrohalic acids 2:1223
 physical behavior 3:2375
- relative humidity (RH)
 aerosol transport analyses 2:1067
 ammonia–nitric acid–sulfuric acid–water (NH₃–HNO₃–H₂SO₄–H₂O) systems 2:1058
 ammonia–nitric acid–water (NH₃–HNO₃–H₂O) systems 2:1058
 deliquescent relative humidity (DRH) 2:1060, 2:1061r
 relative humidity threshold values 4:3314, 4:3315f, 4:3316f
 steel corrosion 3:1714, 3:1715f, 3:1715r
 sulfuric acid–ammonia–water (H₂SO₄–NH₃–H₂O) systems 2:1057, 2:1058f
 surface moisture effects 2:1077
- residual phosphate treatment 4:2980, 4:2981r
- resins
 epoxy resins 3:2342, 3:2342r
 furane resin 3:2341, 3:2342r
 glass fiber-reinforced resins 2:1223–1224, 3:2343
 organic coatings 4:2645, 4:2645f
 phenolic resins 3:2342, 3:2342r
 polyester resins 3:2342
- resin vulcanization 3:2437
- resistance welding 3:2452r, 3:2453f
- response surface regression analysis 2:1562, 2:1563f
- reversed three parameter Weibull (Type III) distribution model 2:1554
- reverse emulsions 4:2905f, 4:2903
- reverse osmosis
 desalination plants 3:1865
 makeup water treatment 4:2973
- reversible thermodynamic systems 1:2
- Reynolds number 2:1609–1610
- rhodium (Rh)
 alumina-forming alloys 1:616
 cobalt-based alloys 3:1918, 3:1918r
 intermetallic alloys 1:656, 1:665
 nickel-based superalloys 1:693r
see also noble metals
- rheological control agents 4:2653
- rhodium (Rh)
 corrosion resistance 3:2216r
 exchange current density 3:2217r
 high-temperature properties 3:2217, 3:2218r
 intermetallic alloys 1:656
 platinum–rhodium (Pt–Rh) alloys 3:2209
 properties 3:2207r, 3:2208
 supply/demand estimations 3:2207r
 thermodynamic behavior 3:2210
- RICE Code 4:2918
- rippled coating 4:2741
- risk-based inspection (RBI) 4:3084–3101
 asset integrity management (AIM) 4:3086, 4:3088f
 background information 4:3084
 case studies
 corrosion rate trending 4:3097, 4:3097f, 4:3098f, 4:3099r
 intelligent data interpretation 4:3098
 management of change (MoC) procedures 4:3099
 robust RBI likelihood modeling 4:3098, 4:3099f
 ultrasonic wall thickness measurements 4:3097, 4:3098f, 4:3099r
 unit layout schematic diagram 4:3100f
- current international practice
 API 580/API 581 4:3238–3239, 4:3016, 4:3016f, 4:3017f, 4:3091
 common practices 4:3092
 general discussion 4:3091

- risk-based inspection (RBI) (*continued*)
 decision-making process 4:3086, 4:3087f
 future developments 4:3101
 inspection plan design
 appropriate inspection technique selection 4:3092
 inspection interval specification 4:3092, 4:3093r
 key performance indicators (KPIs) 4:3240, 4:3005–3006, 4:3266t, 4:3265
 major challenges 4:3100
 management requirements 4:3007f
 management responsibilities 4:3086
 oil and gas industry 4:3238–3239, 4:3263
 process equipment risk management 4:3216–3217
 risk assessment characteristics
 general discussion 4:3087
 qualitative RBI 4:3087
 quantitative RBI 4:3088, 4:3089f
 semiquantitative RBI 4:3089
 risk matrix
 basic concepts 4:3089
 criticality assessments 4:3013, 4:3014t, 4:3015r
 failure probabilities 4:3017f, 4:3018r
 5 x 5 matrix 4:3016, 4:3016f, 4:3091f
 quantitative RBI results 4:3089f
 3 x 3 matrix 4:3090f
 risk versus hazard 4:3085
 success factors
 accurate likelihood modeling 4:3094
 bathtub curve 4:3096f
 confidence criteria 4:3095
 failure rate–time plot 4:3096f
 general discussion 4:3004–3005, 4:3093
 intelligent data interpretation 4:3097
 key factors 4:3094
 operating conditions 4:3093
 RBI practitioners 4:3093
 realistic consequence modeling 4:3096, 4:3096f
 regulatory bodies 4:3094
 risk management
 design-based mitigation 4:3065–3083
 activity and information flow diagram 4:3068f
 coating effectiveness 4:3079f
 design process 4:3065, 4:3066f
 environmental chemistry definitions and control 4:3069, 4:3070f, 4:3071f
 flow disturbances 4:3078f, 4:3079f
 fluid entrapment 4:3076f
 galvanic compatibility risks 4:3078, 4:3079f, 4:3080f
 geographic/shape factors 4:3075, 4:3076f, 4:3077f, 4:3078f, 4:3079f
 heat transfer conditions 4:3070, 4:3071f, 4:3072f, 4:3073f
 life cycle costing 4:3066f
 management strategies 4:3080, 4:3080f
 mechanical design factors 4:3073
 microenvironment factors 4:3068, 4:3069f, 4:3070f, 4:3071f, 4:3072f
 management process guidelines
 basic concepts 4:3007
 information flow guidelines 4:3009, 4:3009f
 process flowchart 4:3008f
 risk analysis, mitigation, and control flowchart 4:3010f
 management requirements 4:3007f
 management systems
 data management systems 4:3032, 4:3034f
 frameworks
 corrosion management systems 4:3026, 4:3027f, 4:3028f
 risk mitigation systems 4:3025, 4:3026f
 key performance indicators (KPIs) 4:3030
 management tools
 corrosion mitigation requirements
 basic concepts 4:3022
 data management systems 4:3024, 4:3025f
 mitigation flowchart 4:3022f
 monitoring techniques 4:3023, 4:3024f, 4:3117–3166
 probability analysis
 basic concepts 4:3018
 corrosion rates 4:3019f
 failure probabilities 4:3021f
 inhibitor performance analysis 4:3020r
 quantitative corrosion risk analysis 4:3020f
 risk assessment guidelines
 control options 4:3016r
 criticality assessments 4:3013, 4:3014t, 4:3015r
 failure probabilities 4:3017f, 4:3018r
 hazards identification 4:3012, 4:3013r
 matrix analyses 4:3013, 4:3014r
 risk-based inspection (RBI) 4:3238–3239, 4:3016, 4:3016f, 4:3017f
 risk identification
 corrosion sources 4:3011
 damage and failure modes 4:3010
 risk assessment flowchart 4:3012f
 petrochemical/chemical industries 4:3207–3229
 industry characteristics 4:3207–3229
 process equipment
 characteristics 4:3208, 4:3208f
 coatings and linings 4:3212
 electrochemical protection 4:3213
 environmental cracking 4:3214f
 environmentally-assisted cracking 4:3217, 4:3217f, 4:3218f, 4:3219f, 4:3220f, 4:3220r
 external corrosion risks 4:3215, 4:3216f
 failure incidents 4:3208–3209, 4:3209f
 future trends 4:3226
 general discussion 4:3227
 inhibitors 4:3213
 internal corrosion risks 4:3217, 4:3217f, 4:3218f, 4:3219f, 4:3220f, 4:3220r
 materials selection 4:3210, 4:3210f, 4:3213
 microprocess equipment 4:3226, 4:3226f
 operating conditions 4:3208, 4:3208f
 operation-based risk mitigation 4:3221, 4:3223f, 4:3224f
 organic waste destruction 4:3225f
 protective treatments 4:3212
 risk-based cost benefit analysis 4:3223, 4:3225f
 risk mitigation guidelines 4:3214
 stress corrosion cracking (SCC) 4:3215f
 supercritical water oxidation (SCWO) 4:3224–3226, 4:3225f
 water system modifications 4:2930–2970
 chemical inhibitors
 cooling systems 4:2964, 4:2965t, 4:2968f
 general discussion 4:2961
 steam boiler systems 4:2961
 closed-loop water systems 4:2943
 cooling systems 4:2964, 4:2965t, 4:2968f
 corrosion mechanisms
 concentrated cell/crevice corrosion 4:2947
 condensate line corrosion 4:2948
 crevice corrosion 2:766
 erosion 4:2948
 galvanic corrosion 4:2946
 general discussion 4:2945
 grooving corrosion 4:2948
 impingement attacks 4:2948
 microbially-induced corrosion (MIC) 4:2949, 4:2949f, 4:2967, 4:2969r
 pitting corrosion 4:2945, 4:2946f
 stress corrosion 4:2947
 uniform corrosion 4:2945
 white rust 4:2949
 heat capacity 4:2931
 importance 4:2931
 industrial heating and cooling systems
 alkalinity 4:2939, 4:2939t, 4:2940t, 4:2953, 4:2958
 bacterial growth count evaluation 4:2969t
 blistering 4:2958f
 chemical inhibitors 4:2961
 contaminant cycles of concentration (COC) 4:2959t, 4:2960, 4:2961r
 contaminant saturation conditions 4:2956
 cooling systems 4:2964, 4:2965t, 4:2968f
 corrosion mechanisms 4:2945
 corrosion mitigation 4:2933, 4:2936f
 corrosion monitoring 4:3143
 corrosion rate quantification 4:2957t
 corrosion test coupon 4:2956f
 corrosion vulnerability data 4:2956r
 freshwater consumption 4:2932, 4:2935f
 hardness 4:2940–2941, 4:2953, 4:2958

- hydrologic cycle 4:2936, 4:2937f
 Langelier saturation index (LSI) 4:2958
 Larson–Skold index (L–SI) 4:2960
 makeup water treatment 4:2959t
 metal and alloy materials selection 4:2955, 4:2956t
 microbially-induced corrosion (MIC) 4:2967, 4:2969t
 microbiological fouling 4:2950, 4:2950f, 4:2967, 4:2969t
 mineral scales, muds, and sludges 4:2941, 4:2942f, 4:2942t, 4:2943f
 organic inhibitors 4:2966, 4:2966f
 pathogenic bacteria 4:2951, 4:2951f
 pretreatment processes 4:2953, 4:2954f
 Puckorius scaling index (PSI) 4:2959
 Ryznar stability index (RSI) 4:2959
 scale formation 4:2935, 4:2936f
 steam boiler systems 4:2961
 treatment guidelines 4:2952
 water chemistry 4:2936, 4:2939t
 water treatment factors 4:2933
- latent heat 4:2932
- new-construction HVAC systems 4:2944
- organic inhibitors 4:2966, 4:2966f
- potable systems
 alkalinity 4:2939, 4:2939t, 4:2940t, 4:2953, 4:2958
 bacterial growth count evaluation 4:2969t
 blistering 4:2958f
 chemical inhibitors 4:2961
 contaminant cycles of concentration (COC) 4:2959t, 4:2960, 4:2961t
 contaminant saturation conditions 4:2956
 corrosion mechanisms 4:2945
 corrosion mitigation 4:2933, 4:2936f
 corrosion rate quantification 4:2957t
 corrosion test coupon 4:2956f
 corrosion vulnerability data 4:2956t
 freshwater consumption 4:2932, 4:2935f
 hardness 4:2940–2941, 4:2953, 4:2958
 hydrologic cycle 4:2936, 4:2937f
 Langelier saturation index (LSI) 4:2958
 Larson–Skold index (L–SI) 4:2960
 makeup water treatment 4:2959t
 metal and alloy materials selection 4:2955, 4:2956t
 microbially-induced corrosion (MIC) 4:2967, 4:2969t
 microbiological fouling 4:2950, 4:2950f, 4:2967, 4:2969t
 mineral scales, muds, and sludges 4:2941, 4:2942f, 4:2942t, 4:2943f
 pathogenic bacteria 4:2951, 4:2951f
 pretreatment processes 4:2953, 4:2954f
 Puckorius scaling index (PSI) 4:2959
 Ryznar stability index (RSI) 4:2959
 scale formation 4:2935, 4:2936f
 treatment guidelines 4:2952
 water chemistry 4:2936, 4:2939t
 water treatment factors 4:2933
- steam boiler systems 4:2961
- rivelling 4:2744
- river waters 3:1853
- rolling techniques 3:1985
- ropiness 4:2733
- rubber 3:2407–2438
 above-water fastener selection 2:847f
 anhydrous hydrogen halide gases/hydrohalic acids 2:1224
 below-water fastener selection 2:849f
 chemically resistant membranes 3:2343, 3:2343t
 classifications
 by ISO designations
 brittleness temperature limits 3:2413t
 general discussion 3:2411
 heat aging temperature 3:2412t
 heat/oil resistance class 3:2413f
 volume swelling limits 3:2412t
 by origin 3:2410
 by purpose 3:2411, 3:2412t
 flex cracking 3:2426
 future developments 3:2437
 heat aging resistance 3:2426, 3:2426f
 latex harvests 3:2410f
 oil absorption effects
 automotive rubber components 3:2427f
 crosslink concentration effects 3:2428, 3:2430f, 3:2430t
 general discussion 3:2427
 mass uptake 3:2430f, 3:2430t
 penetration rate–viscosity relationship 3:2428f, 3:2429f
 swelling resistance 3:2428
 oxidation mechanisms 3:2422, 3:2422f, 3:2423f
 ozone degradation 3:2424, 3:2425f
 processing techniques
 mastication and mixing 3:2416
 rubber compounding 3:2416
 schematic flow chart 3:2417f
 vulcanization 3:2417, 3:2418t
 properties
 chemical structure 3:2415f
 general discussion 3:2409
 mechanical properties 3:2409
 mechanical strength 3:2413
 swelling resistance 3:2415, 3:2416t
 protective measures
 aging effects 3:2431
 anti-degradants
 antiozonant mechanisms 3:2433, 3:2434f, 3:2435f
 basic concepts 3:2432, 3:2432f
 layer formation theories 3:2433, 3:2434f, 3:2435f
 elastomer blends 3:2431
 elastomer selection 3:2431
 paraffin wax blooming 3:2435
 sulfur vulcanization
 conjugated diene and triene groups 3:2436
 cyclic sulfides 3:2436
 disulfidic crosslink 3:2436
 extra-network material 3:2436
 monosulfidic crosslink 3:2436
 pendent accelerator groups 3:2436
 polysulfidic crosslink 3:2436
 vulcanization system
 general discussion 3:2435
 metallic oxide vulcanization 3:2437
 peroxide vulcanization 3:2436
 quinonedioximes vulcanization 3:2437
 resin vulcanization 3:2437
 sulfur vulcanization 3:2436
 urethane crosslinking system 3:2437
- rubber-to-metal bonding
 bond failure 3:2421, 3:2473, 3:2473f
 bonding process
 bonding agents 3:2420
 metal plate preparation 3:2420
 molding methods 3:2420
 engineering and automotive applications 3:2418, 3:2419f
 vulcanization
 general discussion 3:2421
 hot air/ambient temperature technique 3:2421
 steam pressure technique 3:2421
 water curing technique 3:2421
- rubber trees 3:2410f
- solubility 3:2381
- vulcanization processes
 basic concepts 3:2417
 general discussion 3:2435
 metallic oxide vulcanization 3:2437
 peroxide vulcanization 3:2436
 quinonedioximes vulcanization 3:2437
 resin vulcanization 3:2437
 rubber-to-metal bonding
 hot air/ambient temperature technique 3:2421
 steam pressure technique 3:2421
 system characteristics 3:2418t
 water curing technique 3:2421
 sulfur vulcanization
 basic concepts 3:2417
 polysulfidic crosslink 3:2436
 system characteristics 3:2418t
 urethane crosslinking system 3:2437
 water absorption effects 3:2429, 3:2430f, 3:2431f
 rubber-modified amorphous plastics 3:2374
 runs/sags/curtains 4:2741
 rust formation 4:2667

- rust inhibitors 2:1303*t*
 rust rashing 4:2742
 rust spotting 4:2742
 rust staining 4:2742
 ruthenium (Ru)
 corrosion potential 2:1261
 corrosion resistance 3:2216*t*
 exchange current density 3:2217*t*
 high-temperature properties 3:2217, 3:2218*t*
 intermetallic alloys
 aluminide coatings 1:665, 1:665*f*
 oxidation processes 1:659
 ionizing radiation effects 2:1264, 2:1266*f*
 iron-40% chromium-platinum-group metals (Fe-40% Cr-PGM) system 3:2243
 nickel-based superalloys 1:693*t*
 platinum-ruthenium (Pt-Ru) alloys 3:2209
 properties 3:2207*t*, 3:2208
 quaternary/ternary iron-chromium (Fe-Cr) alloy systems 3:2244
 supply/demand estimations 3:2207*t*
 thermodynamic behavior 3:2210
 see also noble metals
 Rutherford back scattering (RBS) spectrometry
 basic concepts 2:1386
 characteristics 2:1376*t*
 spectral data plot 2:1386*f*
 ultrahigh vacuum (UHV) conditions 2:1376
 Ryznar stability index (RSI) 2:1100, 4:2959
- S**
- sabkhas 2:1156
 sacrificial anodes 4:2763-2780
 bare steel protection 4:2774, 4:2774*t*, 4:2775*t*
 basic concepts
 anode capacity 4:2765
 anode efficiency 4:2765
 anode operating potential 4:2764, 4:2765*t*
 driving voltage 4:2764
 fundamental requirements 4:2765
 protection potential 4:2764
 calcareous scale deposits 4:2779
 cathodic protection
 anode resistance 4:2776*f*
 bare steel protection 4:2774, 4:2774*t*, 4:2775*t*
 corrosion management 4:3287, 4:3287*f*
 current density requirements 4:2774
 design guidelines 4:2774
 electrochemical principles 4:2752, 4:2753*f*, 4:2754*t*
 system life 4:2775
 combined alloy anodes 4:2779
 flame sprayed aluminum coatings 4:2780
 high-alloy steel protection 4:2780
 historical background 4:2764
 material requirements 4:2766, 4:2766*t*
 materials selection
 aluminum (Al) 4:2772, 4:2773
 zinc (Zn) 4:2771
 operation principles 4:2764
 performance factors
 alloy compositions 4:2766, 4:2768*t*, 4:2769*t*, 4:2773
 alloying additions 4:2767, 4:2768*t*
 current capacity 4:2771*f*, 4:2772*f*
 electrochemical potential 4:2771*f*
 environmental conditions 4:2770
 impurity effects 4:2767
 metallurgical factors 4:2769
 zinc alloys 4:2767-2768, 4:2768*t*
 system life
 anode inserts 4:2778, 4:2778*f*
 anode life calculations 4:2776
 anode output calculations 4:2775
 anode quantity calculations 4:2777
 anode resistance 4:2776, 4:2776*t*
 backfills 4:2779
 end current distribution 4:2777
 general discussion 4:2775
 size and shape effects 4:2775
 utilization factors 4:2778
 weight calculations 4:2775
 testing methods 4:2773
 sags 4:2741
 saliva
 corrosion-resistant alloys 2:1312*f*
 environmental conditions 2:1312-1313
 salt aerosols 2:1059, 2:1061, 2:1067
 salt solution corrosion 3:1768, 3:1768*t*, 3:1769*t*
 samarium oxide (Sm₂O₃) 3:2197*f*
 sand 2:1155*f*
 sand casting techniques 3:1983, 3:2021
 Sandelin curve 4:2569*f*
 saponification 4:2743
 saturated Calomel electrode (SCE) 2:1371*t*, 4:2849*t*
 scandium (Sc)
 nitric acid (HNO₃) solutions 2:1252*t*
 tetragonal zirconia polycrystals (TZP) 3:2294
 scanning electron microscopy (SEM)
 backscattered electrons 2:1409-1410, 2:1410*f*, 2:1411*f*
 basic concepts 2:1409
 cementite analysis 1:286, 1:287*f*
 characteristics 2:1376*t*
 corrosion product characterizations 1:140, 1:142*f*
 corrosion studies 2:1406, 2:1406*f*
 electron backscatter diffraction (EBSD) 2:880-881, 2:882*f*, 2:1411, 2:1413*f*
 environmental scanning electron microscopy (ESEM) 2:1412
 'glaze' formation analyses 1:383
 secondary electrons 2:1409-1410, 2:1410*f*
 specimen preparation techniques 2:1415*f*, 2:1425
 topographic images 2:1410-1411, 2:1412*f*
 X-ray analyses 2:1419, 2:1419*f*
 scanning Kelvin probe (SKP) method
 cathodic delamination 2:989-991, 2:993
 filiform corrosion 2:997-998, 2:997*f*, 2:1000*f*
 scanning probe microscopy 2:1430-1442
 atomic force microscopy (AFM)
 background information 2:1439
 general discussion 2:1441
 implementation processes 2:1440
 limitations 2:1440
 operating principles 2:1439, 2:1439*f*
 solid/liquid interface applications 2:1440, 2:1441*f*
 background information 2:1431
 electrochemical scanning tunnel microscopy (ECSTM)
 background information 2:1433
 electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*
 general discussion 2:1441
 implementation processes 2:1433, 2:1434*f*
 limitations 2:1433
 solid/liquid interface applications
 active dissolution of metals 2:1434, 2:1435*f*
 general discussion 2:1434
 passive film growth and structure analysis 2:1436, 2:1437*f*
 scanning tunnel microscopy (STM)
 background information 2:1431
 general discussion 2:1441
 'glaze' formation analyses 1:379
 limitations 2:1432
 operating principles 2:1431, 2:1432*f*
 scanning tunnel spectroscopy (STS) 1:379, 2:1432
 solid/gas interface applications 2:1432
 scanning transmission electron microscopy (STEM)
 characteristics 2:1416
 Nimonic alloys-Stellite 6 wear-affected surfaces study
 aluminum oxide segregation 1:387*f*
 'glaze' formation 1:382*f*, 1:383, 1:384*f*
 sliding wear comparisons 1:388*f*
 wear effects 1:385*f*, 1:386*f*
 scanning tunnel microscopy (STM)
 background information 2:1431
 general discussion 2:1441
 'glaze' formation analyses 1:379
 limitations 2:1432
 operating principles 2:1431, 2:1432*f*

- scanning tunnel spectroscopy (STS) 1:379, 2:1432
 solid/gas interface applications 2:1432
- scanning tunnel spectroscopy (STS) 1:379, 2:1432
- Schaeffler–Delong diagram 3:1811, 3:1811*f*
- Scherrer formula 2:1393
- Schmidt number 2:961, 2:1609–1610
- schoepite 3:2190
- scholzite 4:2497*r*
- Schottky disorders 1:111
- screw dislocation 1:104, 1:105*f*, 1:106*f*
- seawater 2:1107–1148
 aluminum alloys
 corrosion rates 2:1139*r*
 corrosion resistance 2:1138
 maximum depth of attack 2:1140*r*
 pit depth measurements 2:1140*f*
 wrought aluminum alloy designations 2:1139*r*
- carbon steel
 adhesive bond failure 3:2476*f*
 corrosion protection methods 2:1143
 corrosion rates
 alloying element influences 3:1702*f*, 3:1702*r*
 corrosion products 2:1114*f*
 corrosion profile 2:1121*f*
 design-based mitigation 4:3080*f*
 exposure rate–dissolved oxygen plot 2:1124*f*
 exposure rate–seawater depth plot 2:1124*f*
 general discussion 2:1120
 hydrogen embrittlement 2:1123–1124
 macrofouling 2:1114*f*
 mass loss 2:1122*f*
 pitting corrosion 2:1122–1123, 2:1122*f*, 2:1123*f*
 polarization curves 2:1114*f*, 2:1120*f*
 seasonal variations 2:1121*r*
 seawater velocity effects 2:1122*f*
- cast iron
 corrosion rates 2:1125*r*, 3:1759*r*, 3:1760*f*, 3:1760*r*, 3:1761*f*, 3:1762*r*, 3:1761*f*
 flow-induced corrosion 3:1778, 3:1779*f*, 3:1780*f*, 3:1780*r*
 general discussion 2:1125, 3:1758
 gray cast iron corrosion rates 3:1759*r*
 sodium chloride (NaCl) concentration effects 3:1758*f*
- copper alloys
 corrosivity 2:1131, 3:1952*r*, 3:1958
 critical design velocities 2:1132*r*
 dealloying 2:1135
 dissolved oxygen–corrosion rate plot 2:1134*f*
 flow-induced corrosion 2:982*f*
 galvanic corrosion 2:1134–1135
 impingement attacks 2:1134
 macrofouling 2:1133
 metal-ion concentration cell corrosion 2:1135
 pitting corrosion 2:1133–1134
 self-corrosion 2:1135
 shear stresses 2:1132*r*
 stress corrosion cracking (SCC) 2:1135
 sulfate-reducing bacteria (SRB) 2:1132–1133
 temperature–corrosion rate plot 2:1133*f*
- corrosion protection methods 2:1143
- corrosion rates
 antifouling coatings 2:1143
 basic concepts 2:1113
 calcareous deposits 2:1115, 2:1115*f*, 2:1116*f*, 2:1117*f*, 2:1117*r*, 2:1143
 calcium/magnesium (Ca/Mg) ratio 2:1115–1116, 2:1117*f*
 cathodic protection 2:1115, 2:1117*f*, 2:1117*r*, 2:1143
 chloride ion sources 2:1113
 contaminant saturation conditions 4:2956
 corrosion product formation 2:1113, 2:1114*f*
 crevice corrosion 2:1116, 2:1118*f*
 current density 2:1115*f*, 2:1117*f*, 2:1117*r*
 galvanic corrosion 2:1118, 2:1119*f*, 2:1120*f*
 macrofouling 2:1113, 2:1114*f*, 3:2458
 oxidation reduction reaction 2:1113
 passive films 2:1116, 2:1118*f*
 polarization curves 2:1113, 2:1114*f*, 2:1120*f*
 sulfate-reducing bacteria (SRB) 2:1114–1115
- environment characteristics
 calcareous deposits 2:1111, 2:1115, 2:1115*f*, 2:1116*f*, 2:1117*f*, 2:1117*r*, 4:2759
 composition
 ionic concentrations 2:1109*r*
 salinity 2:1108, 2:1109*r*, 2:1110*f*
 depth effects 2:1111, 2:1112*f*, 2:1113*f*
 dissolved oxygen 2:1110, 2:1110*f*
 electrolytic resistivity 2:1113, 2:1113*r*
 general discussion 2:1108
 macro/microfouling 2:1111, 2:1113, 2:1114*f*, 3:2458
 pH 2:1110
 temperature effects 2:1111
 velocity factors 2:1111
- galvanic corrosion
 below-water fastener selection 2:849*f*
 corrosion rates 2:851*r*, 2:852*r*, 2:854*r*
 crevice corrosion depth 2:853*r*
 design-based mitigation 4:3080*f*
 sulfidation corrosion 2:850*f*
 tube alloy corrosion rates 2:853*r*
 valve alloys 2:849*f*
 weight loss for iron (Fe) 2:850*r*
- galvanic series 2:831*f*
 general discussion 2:1108
 iron–nickel (Fe–Ni) alloys 3:1791, 3:1791*r*, 3:1792*r*
 magnesium alloy corrosion 3:2013*r*
 magnesium (Mg) 2:1142
 maraging steels 3:1795, 3:1797*f*
 metal–matrix composites 3:2265, 3:2265*f*
 nickel-based alloys 2:1135, 2:1136*r*
 nonmetallic materials 2:1142
 pitting corrosion potential 2:782*f*
 protective coatings 2:1115, 2:1115*f*, 2:1116*f*, 2:1117*f*, 2:1117*r*, 4:2759
 reference electrodes 4:2848, 4:2849*r*
 reverse osmosis desalination plants 3:1865
 sacrificial anode performance 4:2770, 4:2771*f*, 4:2772*f*
 seawater-cooled circulating water systems
 cathodic protection
 continuous anodes 4:2822
 current requirements 4:2812*r*
 galvanic anodes 4:2822
 impressed current anodes 4:2822
 impressed-current systems 4:2823
 rod anodes 4:2822
 tubular anodes 4:2822
- stainless steel corrosion
 anaerobic conditions 3:1857
 cathodic protection 3:1856
 crevice corrosion 2:1125, 2:1126*f*, 2:1127*f*
 critical crevice corrosion solution values 2:1130*r*
 critical crevice corrosion temperature (CCT) 2:759, 2:759*r*, 2:1128, 2:1129*r*
 depth of localized attacks 2:1127*r*
 exposure factors 3:1856, 3:1856*r*, 3:1857*r*
 hydrogen embrittlement 3:1856
 materials selection 3:1854, 3:1855*f*
 maximum depth of crevice attack 2:1128*r*
 pitting corrosion 2:1125, 2:1131*r*
 pitting resistance number (PREN) 2:759, 2:759*r*, 2:1128–1129, 2:1129*r*
 polluted environments 3:1855
 resistance factors 3:1854, 3:1855*r*
 stress corrosion cracking (SCC) 2:1125
 304L 2:1126*f*, 2:1130*r*, 2:1131*r*
 316LVM 2:1127*f*, 2:1129*r*, 2:1130*r*, 2:1131*r*
 testing procedures 2:1146
 titanium alloys 2:1120*f*, 2:1137
 zinc/zinc alloy corrosion 2:1142, 3:2085
- secondary ion mass spectrometry (SIMS)
 basic concepts 2:1387
 characteristics 2:1376*r*
 corrosion product characterizations 1:140, 1:142*f*
 passive film analysis 2:746, 3:1923
 ultrahigh vacuum (UHV) conditions 2:1376
- secondary neutral mass spectrometry (SNMS) 1:140
- second law of thermodynamics 1:3
- selected area diffraction (SAD) 2:1417

- selective corrosion 4:3280
selective dissolution 1:95*t*
self-polishing copolymers (SPCs) 4:2691–2692, 4:2692*t*
semiquantitative risk-based inspections 4:3089
SermaLoy J 4:2540*f*, 4:2548–2549, 4:2549*f*
serpentine (3MgO·2SiO₂·2H₂O) 4:2942*t*
Serpula lacrymans 3:2445
serum research 2:1310*t*
sessile microorganisms 2:1172
settlement 4:2743
shape-memory alloys
 copper/copper alloys 3:1968
 surgical implants
 health effects 2:1310
 historical background 2:1308
 nickel titanium (NiTi) alloys 2:1314
 titanium/titanium alloys 3:2049
shelling 4:2739
Sherwood number 2:962, 2:1609–1610
ships 4:2825, 4:2827*f*
shipworm 3:2442, 3:2445–2445
short-circuit diffusion 1:121, 1:121*f*, 1:122*f*, 1:137, 1:137*f*
shot peening 2:950
shrink films 4:2997
shrouded plasma spraying (SPS) 4:2614–2615
siderite (FeCO₃) 4:2942*t*, 4:3311
Sikla bridge (Sweden) 3:1858*f*
silanes 4:3331
silica fume 3:2354
silicone rubber (Si)
 applications 3:2412*t*
 chemical structure 3:2414*f*
 heat/oil resistance class 3:2411–2413, 3:2413*f*
 protective measures 3:2431
silicones 3:2384
silicon (Si)
 alkaline cleaners 4:2486
 alloys
 alumina-forming alloys 1:608*t*, 1:609*t*
 aluminum alloys 3:1981
 chromia-forming alloys 1:608*t*, 1:609*t*
 chromium-containing alloys 1:584*t*, 1:589
 compositions 1:246*t*
 heat-resisting alloys—carburization effects 1:283
 high silicon cast iron 3:1746, 3:1747*t*, 3:1748*t*
 high-silicon—chromium iron (Si—Cr Fe) alloys (HSCI) 4:2784
 intermetallic alloys 1:658, 1:664
 iron—silicon (Fe—Si) alloys 4:2783
 low-alloy steels 1:566
 magnesium alloys 3:2015, 3:2016*t*, 3:2019*t*
 magnesium—silicon-containing alloys 3:1981
 silicon—aluminum (Si—Al) alloys 2:1440, 2:1441*f*
 silicon bronzes 2:831*f*, 2:1119*f*, 3:1943, 3:1952*t*
 silicon—molybdenum iron (Si—Mo Fe) alloys 4:2784
 stainless steels 2:1232–1233, 3:1810
 aluminosilicate ceramics 3:2289, 3:2302*f*
 anodic protection 4:2874*t*
 borosilicate glass 2:1224, 2:1248, 3:2307, 3:2308*t*, 3:2309*t*, 3:2324*t*, 3:2325*t*
 cast iron corrosion
 hydrochloric acid (HCl) 3:1765, 3:1765*f*
 liquid sulfur 3:1774*t*
 mineral acids 3:1766
 nitric acid (HNO₃) 3:1766*f*
 phosphoric acid (H₃PO₄) 3:1765, 3:1766*f*, 3:1767*t*
 sulfuric acid (H₂SO₄) 3:1764, 3:1764*f*
 chemically resistant membranes 3:2343
 cobalt silicide (CoSi/Co₂Si/CoSi₂) 1:125–126, 1:126*f*, 1:209
 cordierite (Al₃Mg₂(Si₅AlO₁₈)) 1:674
 diffusion coatings 4:2535*t*
 ferritic chromium steels 1:501*t*
 high-silicon—chromium iron (Si—Cr Fe) alloys (HSCI) 4:2784
 high silicon iron (HSI)
 high-silicon—chromium iron (Si—Cr Fe) alloys (HSCI) 4:2784
 iron—silicon (Fe—Si) alloys 4:2783
 silicon—molybdenum iron (Si—Mo Fe) alloys 4:2784
 sulfuric acid (H₂SO₄) corrosion 2:1230
 high-temperature coatings 1:702, 1:703*f*
 hot dip aluminization 4:2572
 iron—silicon (Fe—Si) alloys 4:2783
 magnesium silicate (3MgO·2SiO₂·2H₂O) 4:2942*t*
 manganese/silicon (Mn/Si) oxide 1:413*f*
 metallurgical properties 3:2169*t*
 metal—matrix composites 3:2251
 molybdenum disilicide (MoSi₂) 1:145*f*, 1:209, 1:552, 3:2301
 Portland cement 3:2350
 resistivities 3:2257*t*
 silica fume 3:2354
 silicate-based mortars 3:2341, 3:2342*t*
 silicic acid (Si(OH)₄) 1:409, 1:411*f*, 1:413*f*
 silico-carbonitrides 1:680
 silicon carbide (SiC)
 advanced technical ceramics
 chemical vapor deposition (CVD) silicon carbides 3:2299
 comparative attack rates 3:2302*f*
 corrosion resistance 1:675, 1:676*f*, 3:2285
 hot corrosion 1:675, 1:676*f*
 liquid phase sintered silicon carbides 3:2299
 material types 3:2297
 parabolic rate constant plot 1:677*f*
 partial pressure effects 1:676*f*
 penetration time—temperature plot 1:679*f*
 reaction-bonded silicon carbides 3:2297
 silicon carbide/titanium carbide (SiC/TiC) composites 3:2299
 sintered silicon carbides 1:677, 1:678*f*, 3:2298
 anhydrous hydrogen halide gases/hydrohalic acids 2:1224
 chemically resistant bricks 3:2339, 3:2340*t*
 metal—matrix composites 3:2251
 process equipment materials 4:3211*f*
 properties 1:275*t*
 resistivities 3:2257*t*
 sulfuric acid (H₂SO₄) environments 2:1248
 thermal expansion coefficients 1:145*f*
 silicon dioxide (SiO₂)
 alkali—silica reaction (ASR) 3:2362, 3:2362*f*
 amorphous alloys 3:2197*f*
 commercial glasses 3:2307
 corrosion resistance 3:2290*t*
 cristoballite (SiO₂) 4:2942*t*
 enamel frit compositions 3:2321*t*, 3:2331*t*
 equilibrium oxygen partial pressure 1:410*f*
 fracture toughness values 1:168*t*
 free energy 1:542*f*
 glass compositions 3:2308*t*
 high-temperature coatings 1:693, 1:702, 1:703*f*
 metal—matrix composites 3:2251
 oxidation processes
 general discussion 1:208
 high-temperature oxidation 1:182*t*, 1:183*f*, 1:552, 1:554*f*
 silicides 1:209, 1:210*f*
 silicon-containing alloys 1:208, 1:208*f*
 water vapor effects 1:553, 1:553*t*
 oxide basicity 1:477*f*
 oxide solubility 1:476–477, 1:476*f*
 Pilling—Bedworth ratio (PBR) 1:160*t*
 Poisson ratios 1:170*t*
 Portland cement 3:2349, 3:2350*t*
 scale formation 2:1102
 silica bricks 3:2340, 3:2340*t*
 solubility plot 1:320*f*
 superheater deposit composition 1:464*t*
 surface fracture energies 1:170*t*
 vitreous silica
 alkaline solutions 3:2315
 applications 3:2316
 basic oxides 3:2316
 boiling water/steam conditions 3:2315
 characteristics 3:2314
 chemical attack resistance 3:2315
 electrical characteristics 3:2315
 fluorine corrosion 3:2315
 heat resistance 3:2315
 hydrofluoric acid (HF) 3:2315
 manufacturing processes 3:2314

- metal reaction products 3:2316
 pH 3:2316f
 polymorphic structure 3:2314, 3:2315f
 thermal conductivity 3:2315
 thermal expansion coefficients 3:2314
 silicon-iron (Si-Fe) anodes 4:2813, 4:2814t
 silicon-modified aluminides 4:2548, 4:2549f
 silicon-molybdenum iron (Si-Mo Fe) alloys 4:2784
 silicon nitride (SiN/Si₃N₄)
 advanced technical ceramics
 comparative attack rates 3:2302f
 corrosion resistance 1:678, 3:2285
 hot corrosion 1:678-679
 material types 3:2299
 penetration time-temperature plot 1:679f
 reaction-bonded silicon nitrides 3:2300
 sintered silicon nitrides 3:2300
 high-temperature tribocorrosion 1:355f, 1:360f, 1:364f, 1:365f, 1:371, 1:372f
 nitridation processes 1:308f
 silicon carbide (SiC) bricks 3:2339, 3:2340t
 soda-lime glass 3:2324t, 3:2325t
 sodium disilicate (Na₂Si₂O₅) 4:2564f
 sodium hexafluorosilicate (Na₂SiF₆) 3:2331t
 sodium silicate (Na₂SiO₃) 4:2938-2939
 stainless steels 2:1232-1233, 3:1810, 3:1874t
 thermal expansion coefficients 1:145f
 titanium silicide (Ti₃Si₃) 1:209, 1:702, 1:703f
 titanium silicide (TiSi₂) 1:145f, 1:209
 water chemistry 4:2938, 4:2939t
 zinc silicate coatings 4:2695t, 4:2698t
 silt 2:1155f
 silver (Ag)
 alkali corrosion 2:1204
 alloys
 galvanic corrosion 2:831f, 2:851t, 2:1119f
 impressed current anodes 4:2814t, 4:2815
 anhydrous hydrogen halide gases/hydrohalic acids 2:1223
 anodic protection 4:2874t
 archaeological metals 4:3311f
 corrosion behavior
 anodic processes 3:2212
 atmospheric corrosion 3:2213
 tarnishing 3:2213
 corrosion removal methods 4:3322
 crystal structure 1:55t
 electrochemical scanning tunnel microscopy (ECSTM) 2:1436
 electroplated coatings 4:2584, 4:2588t, 4:2589
 galvanic corrosion 2:831f, 2:851t
 high-temperature properties 3:2217
 intermetallic alloys 1:658-659
 lead-silver (Pb-Ag) alloys 3:2055, 3:2055t, 4:2814t, 4:2815
 magnesium alloys 3:2019t
 nitric acid (HNO₃) solutions 2:1252t
 potential-pH (Pourbaix) diagram 3:2210f
 production background 3:2206
 properties 3:2206, 3:2207t
 redox couples equilibrium potential values 1:26t
 reference electrodes 1:46, 1:48t, 2:1371t, 4:2847-2848, 4:2849f, 4:2849t, 4:2850f
 silver chloride (AgCl) 1:46, 1:48t, 2:1371t, 4:2847-2848, 4:2849f, 4:2849t, 4:2850f
 silver-copper (Ag-Cu) alloys 1:67f
 silver cyanide (AgCN) 4:2584, 4:2585f, 4:2589, 4:2591t
 silver-gold (Ag-Au) alloys 2:803f, 2:805f, 2:806f, 2:867t, 3:2215
 silver oxide (Ag₂O) 3:2197f, 3:2210f
 silver sulfate (Ag₂SO₄) 3:2212
 supply/demand estimations 3:2207t
 thermodynamic behavior 3:2209, 3:2210f
 sintered polyethylene coatings 4:3283t
 sintered silicon carbides 1:677, 1:678f, 3:2298
 skips 4:2739
 sliding wear-corrosion 2:1033, 2:1040
 slimes 2:1111, 2:1182, 4:2949
 see also biofilms
 sludges
 chemical compositions 4:2942t
 closed-loop water systems 4:2943
 cooling systems 4:2943, 4:2943f
 general discussion 4:2941
 new-construction HVAC systems 4:2944
 potable water lines 4:2944
 purification methods 3:1871
 steam boiler systems 4:2941, 4:2942f
 slurry cementation process 4:2535t, 4:2538, 4:2540f
 SMARTCOAT concept 4:2551, 4:2552f, 4:2553f
 smart coatings 4:2650
 SMART MCrAlY overlay coatings 1:699, 1:699f, 1:700f
 smytheite 2:1288
 Society of Automotive Engineers (SAE) 4:3053
 soda-lime glass 3:2324t, 3:2325t
 sodium (Na)
 alkaline cleaners 4:2486
 atmospheric conditions 2:1082t
 caustic soda (NaOH)
 aluminum coatings 4:2564f
 anodic protection
 corrosion rates 4:2884, 4:2885f
 potentiodynamic curves 4:2885f
 reference electrodes 4:2874t
 storage tanks 4:2888
 boiler water treatment 4:2986
 characteristics 2:1191
 chemical process industry and environmental technology 3:1902, 3:1902f
 glass linings and coatings 3:2324t
 nickel-copper (Ni-Cu) alloys 2:1200f, 3:1884
 stress corrosion cracking (SCC) 4:3058f
 corrosive environments 1:405
 disodium octaborate (Na₂B₈O₃·4H₂O) 2:1328
 disodium octaborate tetrahydrate (DOT) 3:2441
 disodium oxide (Na₂O)
 enamel frit compositions 3:2321t, 3:2331t
 fireside corrosion 1:470, 1:470f, 1:472f
 glass compositions 3:2308t
 Pilling-Bedworth ratio (PBR) 1:146t
 Portland cement 3:2349, 3:2350t
 superheater deposit composition 1:464t
 fire-retardant treatment chemicals 2:1328
 fuel chemistry 1:459, 1:459t
 oil-fired boiler corrosion 1:404
 rain chemistry 2:1064t
 seawater constituents 2:1109t
 soda ash (Na₂CO₃) 4:2982, 4:2983f
 soda-lime glass 3:2324t, 3:2325t
 sodium carbonate (Na₂CO₃) 3:2324t, 4:2564f
 sodium chloride (NaCl)
 beryllium (Be) corrosion 3:2170, 3:2170f
 body fluid levels 2:1311-1312, 2:1312t
 corrosion predictions 4:3059t
 corrosion-resistant alloys 2:1311, 2:1312f
 marine aerosols 2:1059, 2:1061
 metal-matrix composites 3:2265, 3:2265f
 paint protection mechanisms 4:2672
 phase diagram 1:531f
 pitting corrosion 2:779f, 2:791f
 seawater constituents 2:1109
 superheater deposit composition 1:465f
 vapor pressure-temperature plot 1:403f
 water chemistry 4:2938-2939, 4:2939t
 sodium cyanide (NaCN) 4:2584
 sodium disilicate (Na₂Si₂O₅) 4:2564f
 sodium fluoride (NaF) 3:2119t, 4:2537t
 sodium hexafluorosilicate (Na₂SiF₆) 3:2331t
 sodium hydroxide (NaOH)
 aluminum coatings 4:2564f
 anodic protection 4:2874t
 boiler water treatment 4:2986
 characteristics 2:1191
 chemical process industry and environmental technology 3:1902, 3:1902f
 nickel-copper (Ni-Cu) alloys 3:1884
 sodium hypochlorite (NaOCl) 3:2216t, 4:2968
 sodium-iron-sulfur-oxygen (Na-Fe-S-O) phase diagram 1:320f

- sodium (Na) (*continued*)
sodium nitrite (NaNO_2) 3:2331*t*
sodium phosphate (Na_3PO_4) 4:2938–2939
sodium:phosphate (Na_3PO_4) molar ratio
congruent phosphate treatment 4:2983
coordinated phosphate treatment 4:2983, 4:2983*f*
equilibrium phosphate treatment 4:2984, 4:2985*f*
sodium silicate (Na_2SiO_3) 4:2938–2939
sodium sulfate (Na_2SO_4)
hot-salt corrosion 1:325, 1:326*f*, 1:478*f*, 1:675
metal–matrix composites 3:2265, 3:2265*f*
oxide solubility 1:320–321, 1:320*f*, 1:531*f*
phase diagram 1:531*f*
superheater deposit composition 1:461, 1:465*f*
water chemistry 4:2938–2939
sodium sulfide (Na_2S) 1:320*f*
sodium sulfite (Na_2SO_3) 4:2975–2976, 4:2976*t*
water chemistry 2:1098*t*
- soft rot 3:2445
- softwoods *see* wood
- soil corrosion 2:1149–1168
aluminum alloys 3:1998
cast iron 3:1760, 3:1762*t*
cathodic protection 4:2816, 4:2816*f*
control options 2:1166
copper/copper alloys 2:1158, 2:1159*f*, 3:1949, 3:1949*t*
corrosion mechanisms
bronze spearheads 2:1153*f*
carbon steel pipeline 2:1152*f*
cast iron pipes 2:1152*f*
copper pipes 2:1152*f*
general discussion 2:1152
corrosion rates
aeration factors 2:1158, 2:1160*f*
archaeological metals 2:1159
carbon steel/low-alloy steel 2:1157, 2:1157*f*, 2:1158*f*, 2:1159*f*
copper (Cu) 2:1158, 2:1159*f*
disturbed/undisturbed conditions 2:1159, 2:1161*f*
lead (Pb) 2:1158, 2:1159*f*
long-term corrosion 2:1159
soil parameter influences 2:1158
stainless steels 2:1158, 2:1158*t*, 2:1165*t*
zinc (Zn) 2:1158, 2:1159*f*
corrosion test methods 2:1471, 2:1507
corrosivity/aggressivity assessments
assessment method characteristics 2:1164
AWWA/DIPRA (American Water Works Association/Ductile Iron Pipe Research Association) system 2:1162, 2:1163*f*
DIN 50 929 Part 3 criteria 2:1162, 2:1162*t*
direct measurement approach 2:1164
Eyre and Lewis system 2:1162
Mean Time Before Failure (MTBF) method 2:1163
methodologies 2:1161
resistivity tests 2:1161, 2:1161*t*
sulfate-reducing bacteria (SRB) 2:1161
- iron (Fe) 2:1159*f*
lead (Pb) 2:1158, 2:1159*f*, 3:2062
metallic coatings 2:1165, 2:1166*f*
pipeline corrosion management 4:3278, 4:3278*f*
protective coatings 4:2702–2719
buried and ground-contact structures 4:2702
coating characteristics 4:2704
coating types
cold-applied tapes 4:2707
field joint coatings 4:2711, 4:2711*f*, 4:3284
laminated tapes 4:2707
line pipe coatings 4:2707, 4:2708*f*
liquid-applied coatings (paint) 4:2705, 4:2706*f*, 4:3283, 4:3283*t*
petrolatum tapes 4:2707
pressure-sensitive tapes 4:2707
- FBE-polypropylene
application frame 4:2713*f*
application methods 4:2715*f*
basic concepts 4:2713
coextruded sheet method 4:2714*f*
coextruded spiral tape 4:2715*f*
injection molding 4:2714*f*
plastic extrusion welding 4:2714*f*
- field joint coatings
FBE-polypropylene 4:2713, 4:2714*f*
FBE powder coatings 4:2712, 4:2713*f*
general discussion 4:2711
liquid-applied field joint coatings 4:2711, 4:2712*f*
pipeline corrosion management 4:3284
radiation cross-linked heat shrink sleeves 4:2712
set-up 4:2711*f*
- line pipe coatings
coal tar and asphalt/bitumen enamels 4:2709, 4:2812*t*, 4:3283, 4:3283*t*
FBE powder coatings 4:2708*f*, 4:2709, 4:2812*t*, 4:2836*f*, 4:3283, 4:3283*t*
general discussion 4:2707
line pipe coating plant schematic diagram 4:2708*f*
polyolefin coatings 4:2708*f*, 4:2710, 4:2812*t*, 4:3283, 4:3283*t*
- pipelines
FBE-polypropylene 4:2713
field joint coatings 4:2711, 4:2711*f*, 4:2713
line pipe coatings 4:2707, 4:2708*f*
liquid-applied coatings (paint) 4:2705, 4:2706*f*
refurbishment methods 4:2716
thermal insulation 4:2715, 4:2716*f*
quality control methods 4:2717
surface preparation 4:2705
resistivity surveys 4:2816, 4:2816*f*
- soil characteristics
aeration 2:1154
classifications 2:1154, 2:1155*f*
clays 2:1154
definitions 2:1153
microbially-induced corrosion (MIC) 2:1156
oxygen diffusion 2:1154
structure 2:1154
texture 2:1154
variable conditions 2:1156
water (H_2O) interactions
capillary water 2:1156
free ground water 2:1156
gravitational water 2:1156
significance 2:1155
- steel corrosion
buried steel
long-term burial 3:1733
pilings 3:1732
pipelines 3:1733
controlling factors 3:1731, 3:1732*t*
sulfate-reducing bacteria (SRB) 2:1175
zinc (Zn)
zinc coatings 2:1158, 2:1159*f*, 4:2562, 4:2563*t*
zinc/zinc alloys 3:2085, 3:2087*t*
- soldering and brazing methods
brazed joints 3:2451
filler materials 3:2450, 3:2451*t*
fluxes 3:2451*t*
general discussion 3:2450
joining processes 3:2452*t*
soldered joints 3:2450
traditional alloys 3:2451*t*
- solders 2:851*t*, 3:2075
- solid-metal embrittlement 4:3183
- solid oxide fuel cells (SOFCs) 1:482–517
basic concepts
general discussion 1:483
material thermal expansion coefficients 1:484*t*
schematic diagram 1:483*f*
- chromium-based materials
anode-side interactions 1:510, 1:511*f*, 1:512*f*
behavior in hydrogen/water ($\text{H}_2/\text{H}_2\text{O}$)-based gases 1:488, 1:489*f*
cathode-side interactions 1:507, 1:508*f*
component thickness effects 1:502, 1:503*f*, 1:504*f*, 1:505*f*
dual atmosphere conditions 1:507
electronic conductivity 1:492, 1:493*f*
equilibrium constants 1:488*f*
ferritic chromium steels
alloying elements 1:494*t*
anode gas effects 1:494, 1:496*f*, 1:497*f*

- anode-side interactions 1:510, 1:511*f*, 1:512*f*
 carbonaceous gas formation 1:497, 1:498*f*
 cathode-side interactions 1:507, 1:508*f*
 characteristics 1:492
 component thickness effects 1:502, 1:503*f*, 1:504*f*, 1:505*f*
 compositions 1:501*t*
 contact resistance 1:501*f*
 design guidelines 1:499
 dual atmosphere conditions 1:507
 metal-glass sealant interactions 1:512, 1:513*f*
 oxidation rates 1:500*f*
 oxide scale formation 1:495*f*, 1:496*f*, 1:501*f*, 1:506*f*
 temperature dependence effects 1:502*f*
 vaporization protection methods 1:509, 1:510*f*, 1:511*f*
 gas compositions 1:497*t*
 metal-glass sealant interactions 1:512, 1:513*f*
 mixed-gas corrosion 1:489, 1:490*f*, 1:491*f*
 oxidation rates 1:490, 1:492*f*
 oxide dispersion strengthened (ODS) alloys 1:485, 1:486*f*, 1:487*f*
 oxygen partial pressure effects 1:498*f*
 scale formation 1:490*f*, 1:491*f*, 1:495*f*, 1:496*f*, 1:506*f*
 vaporization protection methods 1:509, 1:510*f*, 1:511*f*
 volatile species 1:485
 high-temperature metallic alloys 1:484
 solid particle erosion 2:978
 solid-phase welding 3:2452*t*
 solvent-free epoxy coatings 4:2694*t*
 solvent lifting 4:2743
 solvent popping 4:2743
 solvents
 organic coatings 4:2645, 4:2645*f*, 4:2654
 solvent cleaning
 emulsifiable cleaners 4:2485
 emulsion cleaners 4:2485
 vapor degreasing 4:2484
 sour corrosion
 hydrogen-induced cracking (HIC) 4:3294, 4:3295*f*
 materials selection 4:3295
 pipeline corrosion management 4:2902*f*, 4:3294
 stress-oriented HIC 4:3295
 sulfide stress corrosion cracking (SSCC) 4:3294
 spatial distribution modeling 2:1582
 specially-formulated lubricants 2:1306
 specialty rubbers 3:2412*t*
 specific heat capacity (water) 4:2931
 spectroscopy 2:1374–1404
 alternating current (AC) impedance spectroscopy (ACIS) 4:3130
 attenuated total reflection spectroscopy 2:1376*t*, 2:1402
 Auger electron spectroscopy (AES)
 atmospheric corrosion 3:2072
 basic concepts 2:1384
 characteristics 2:1376*t*
 energy diagram 2:1384*f*
 passive film analysis 2:746, 3:1923, 3:2244
 ultrahigh vacuum (UHV) conditions 2:1376
 basic concepts 2:1375
 characteristics 2:1376*t*
 current imaging tunnel spectroscopy (CITS) 1:379
 electrochemical impedance spectroscopy (EIS)
 advanced measurement techniques 2:1360
 basic concepts 2:1358
 data analysis 2:1360
 data presentation 2:1359, 2:1359*f*
 passive film analysis 2:746
 Randles equivalent circuit 2:1359*f*
 electrochemical tunneling spectroscopy (ECTS) 2:1438, 2:1438*f*
 electron energy loss spectroscopy (EELS) 1:383, 1:385*f*, 2:1408, 2:1421, 2:1423*f*
 energy dispersive spectrometry (EDS) 2:1418
 Fourier transform infrared (FTIR) spectroscopy 3:2393
 general discussion 2:1403
 glow discharge optical emission spectroscopy (GDOES)
 basic concepts 2:1398
 characteristics 2:1376*t*
 depth profile 2:1401*f*
 schematic diagram 2:1399*f*
 infrared spectroscopy
 attenuated total reflection spectroscopy
 basic concepts 2:1402
 characteristics 2:1376*t*
 basic concepts 2:1402, 2:1426
 characteristics 2:1376*t*
 IR reflection absorption spectroscopy (IRRAS)
 basic concepts 2:1403
 characteristics 2:1376*t*
 tin analyses 3:2071
 ion scattering spectrometry (ISS)
 basic concepts 2:1385
 characteristics 2:1376*t*
 depth profile 2:1385*f*
 passive film analysis 3:1923
 ultrahigh vacuum (UHV) conditions 2:1376
 ion spectrometry
 general discussion 2:1385
 ion scattering spectrometry (ISS)
 basic concepts 2:1385
 characteristics 2:1376*t*
 depth profile 2:1385*f*
 ultrahigh vacuum (UHV) conditions 2:1376
 Rutherford back scattering (RBS) spectrometry
 basic concepts 2:1386
 characteristics 2:1376*t*
 spectral data plot 2:1386*f*
 ultrahigh vacuum (UHV) conditions 2:1376
 secondary ion mass spectrometry (SIMS)
 basic concepts 2:1387
 characteristics 2:1376*t*
 corrosion product characterizations 1:140, 1:142*f*
 ultrahigh vacuum (UHV) conditions 2:1376
 IR reflection absorption spectroscopy (IRRAS) 2:1376*t*, 2:1403
 photoluminescence spectroscopy (PLS) 1:140
 Raman spectroscopy 1:140, 1:162–163, 1:163*f*, 2:1427, 2:1428*f*, 3:2071
 scanning tunnel spectroscopy (STS) 2:1432
 secondary ion mass spectrometry (SIMS)
 basic concepts 2:1387
 characteristics 2:1376*t*
 corrosion product characterizations 1:140, 1:142*f*
 passive film analysis 2:746, 3:1923
 ultrahigh vacuum (UHV) conditions 2:1376
 secondary neutral mass spectrometry (SNMS) 1:140
 surface analytical methods 2:1375, 2:1376*t*
 time-of-flight secondary ion mass spectrometry (TOF-SIMS) 2:1387, 3:2465
 ultrahigh vacuum (UHV) conditions 2:1376, 2:1377*f*
 ultraviolet photoelectron spectroscopy (UPS)
 basic concepts 2:1382
 characteristics 2:1376*t*
 energy diagram 2:1383*f*, 2:1384*f*
 wavelength dispersive spectrometry (WDS) 2:1418
 X-ray photoelectron spectroscopy (XPS)
 adhesive bond failure 3:2465, 3:2469, 3:2470*f*, 3:2471*f*, 3:2472*f*
 angular resolved XPS (ARXPS) measurements 2:1380–1382, 2:1381*f*
 atmospheric corrosion 3:2072
 Auger energy yield 2:1380*f*
 basic concepts 2:1378
 characteristics 2:1376*t*
 corrosion product characterizations 1:140
 energy diagram 2:1379*f*
 iron oxidation film evaluations 2:1380–1382, 2:1381*f*, 2:1382*f*
 passive film analysis 2:746, 2:1380–1382, 2:1381*f*, 2:1382*f*, 3:1923, 3:1925*f*, 3:2244
 schematic diagram 2:1378*f*
 ultrahigh vacuum (UHV) conditions 2:1376, 2:1377*f*
 Sphaerotilus spp. 2:1183, 4:2920
 Sphingomonas spp. 2:1179
 spinel phase growth 1:588
 spin-galvanizing 4:2568
 spleen research 2:1310*t*
 sprayed coatings 4:2610–2621
 air-assisted airless spray application 4:2640
 airless spray application 4:2639

- sprayed coatings (*continued*)
 applications
 corrosion-resistant coatings 4:2618
 inorganic sprayed coatings 4:2620
 metallic coatings 4:2618, 4:2626
 coatings 4:2521
 electrostatic spray application 4:2640
 heated spray application 4:2640
 metallic coatings 4:2521
 nonthermal spraying
 air spraying 4:2610, 4:2638
 electrostatic spray deposition (ESD) 4:2611, 4:2640
 thermal spraying
 basic concepts 4:2611
 cold-gas dynamic spraying (CGDS) 4:2612*t*, 4:2616
 detonation gun spraying (D-Gun) 4:2612*t*, 4:2616
 flame spraying
 characteristics 4:2612, 4:2612*t*
 high-velocity suspension flame spraying (HVSFS) 4:2613
 reactive flame spraying (RFS) 4:2613
 high-velocity oxy-fuel (HVOF)/high-velocity air fuel (HVAF)
 spraying 4:2612*t*, 4:2615, 4:2626
 laser-hybrid techniques 4:2617, 4:2627, 4:2633*r*
 laser surface melting/remelting (LSM) 4:2626, 4:2633*r*
 liquid feedstock 4:2617
 magnesium alloys 3:2036
 metallic glass coatings 4:2617
 metal matrix composite (MMC) coatings 4:2626–2627
 nanostructured coatings 4:2617
 plasma spraying
 characteristics 4:2612*t*, 4:2614
 high-pressure plasma spraying (HPPS) 4:2615
 inert plasma spraying (IPS) 4:2615
 low-pressure plasma spraying (LPPS) 4:2615
 plasma-transferred arc (PTA) spraying 4:2615
 radio frequency (RF) induction plasma spraying 4:2615
 shrouded plasma spraying (SPS) 4:2614–2615
 supersonic RF plasma spraying 4:2615
 vacuum plasma spraying (VPS) 4:2615
 postprocessing techniques 4:2618
 preprocessing processing techniques 4:2618
 wire arc spraying 4:2612*t*, 4:2613
 tin coatings 3:2074
 spruce 2:1325*r*
 sputter deposition 3:2192–2193
 squeeze casting techniques 3:2022
 SS *Great Britain* 4:3316*f*, 4:3317, 4:3335–3336, 4:3336*f*, 4:3338
 stabilized zirconia 3:2294
Stachybotrys spp. 4:2933–2934
 staining of wood 3:2444, 3:2445
 stainless steels 3:1802–1878
 above-water fastener selection 2:847*f*
 acid pickling 4:2489, 4:2993*r*
 alkali corrosion
 alloying element influences 2:1199*f*, 2:1200*f*
 austenitic stainless steels 2:1198*f*, 2:1199*f*
 composition effects 2:1197*t*, 2:1201*t*
 corrosion potential 2:1196
 corrosion rates 2:1198*f*
 duplex stainless steels 2:1199*f*, 2:1202*f*
 general corrosion 3:1843, 3:1844*f*
 potentiodynamic polarization curves 2:1196*f*
 stress corrosion cracking (SCC) 3:1833
 alloy 20
 corrosion resistance 3:1891
 galvanic corrosion 2:831*f*, 2:1119*f*
 historical development 3:1882*r*
 hydrofluoric acid (HF) production 3:1907
 major alloying elements 3:1881*t*
 maximum depth of crevice attack 2:1128*r*
 pitting resistance 3:1897*t*
 sulfuric acid (H₂SO₄) environments 2:1238*f*
 sulfuric acid (H₂SO₄) production and handling 3:1903
 alloying elements
 aluminum (Al) 3:1811
 carbon (C) 3:1810
 cerium (Ce) 3:1811
 chromium (Cr) 2:1232–1233, 2:1233*f*, 3:1809
 cobalt (Co) 3:1811
 compositional ranges 3:1808*r*
 copper (Cu) 2:1232–1233, 2:1233*f*, 3:1809
 corrosion resistance 2:1230
 general discussion 3:1809
 manganese (Mn) 3:1810
 molybdenum (Mo) 2:1232–1233, 2:1233*f*, 3:1809
 nickel (Ni) 2:1232–1233, 3:1809
 niobium (Nb) 3:1811
 nitrogen (N) 3:1810
 silicon (Si) 2:1232–1233, 3:1810
 sulfur (S) 3:1811
 titanium (Ti) 3:1810
 vanadium (V) 3:1811
 anhydrous hydrogen halide gases/hydrohalic acids
 austenitic stainless steels 2:1209*f*, 2:1212*f*
 corrosion rates 2:1211, 2:1211*t*, 2:1212*f*
 duplex stainless steels 2:1212*f*
 hydrofluoric acid (HF) 2:1212*f*
 anodic protection 4:2874*t*, 4:2878
 applications 3:1807, 3:1807*f*, 3:1807*t*, 3:1860
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*r*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 2:848*f*, 3:1858, 3:1858*r*
 atomic force microscopy (AFM) 2:1441
 austenitic–ferritic (duplex) stainless steels
 intergranular corrosion 2:818
 marine corrosion 2:1125
 austenitic stainless steels
 acid pickling 4:2993*r*
 alkali corrosion 2:1198*f*, 2:1199*f*
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209*f*, 2:1212*f*
 anodic protection 4:2874*t*, 4:2878
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*r*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 3:1858, 3:1858*r*
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1855*t*, 3:1863*t*,
 3:1864*t*, 3:1874*t*
 chemical plant heating/cooling waters 2:1334
 chromium-containing alloys 1:591, 1:591*f*, 1:592*f*, 1:592*t*, 1:593*f*
 commercial applications
 art and architecture 3:1858*f*, 3:1866, 3:1867*f*, 3:1866*f*
 domestic products/kitchenware 3:1860, 3:1861*t*
 process industry 3:1861
 compositional ranges 3:1808*r*
 corrosion properties
 alloy composition influence 3:1825, 3:1826*f*
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830*f*
 crevice formers 3:1850*f*
 critical crevice corrosion temperature (CCT) 3:1850*f*
 critical pitting temperature (CPT) 3:1827, 3:1828*f*, 3:1829*f*, 3:1847,
 3:1848*f*, 3:1849*f*
 electrochemical reactions 3:1823, 3:1824*f*
 electrochemical testing methods 3:1846, 3:1847*f*
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845*f*
 general corrosion 3:1838
 general discussion 3:1821
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*, 3:1850*f*
 grade screening methods 3:1849, 3:1850*f*
 intergranular corrosion 3:1845, 3:1845*f*
 laboratory tests 3:1850, 3:1851*t*
 localized corrosion 3:1824
 material selection tests 3:1849
 passive films 3:1822, 3:1822*f*
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826*f*

- pitting potentials 3:1849f
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825r
 polarization curves 3:1824f
 postweld treatments 3:1837
 stress corrosion cracking (SCC) 3:1830, 3:1831f
 welding-related corrosion 3:1837
- crevice corrosion 2:759
 cyclic oxidation 1:592f, 1:592t, 1:593f
 design-based mitigation 4:3070f, 4:3071f
 electrochemical scanning tunnel microscopy (ECSTM) 2:1436
 erosion resistance 2:985f
 flow-induced corrosion 2:982f, 2:983f
 galvanic corrosion 2:851t, 2:852t, 2:853t
 general corrosion
 - alkaline solutions 3:1843, 3:1844f
 - characteristics 3:1838
 - hydrochloric acid (HCl) 3:1840, 3:1840f
 - nitric acid (HNO₃) 3:1842
 - organic acids 3:1842, 3:1843f
 - phosphoric acid (H₃PO₄) 3:1841, 3:1841f, 3:1842f
 - sulfuric acid (H₂SO₄) 3:1838, 3:1839f, 3:1840f
- heat treatments
 - general discussion 3:1818
 - precipitation hardening 3:1819
 - quenching 3:1818
 - solution annealing 3:1818, 3:1818t
 - stabilization annealing 3:1819
 - tempering 3:1819
- high temperature oxidation behavior 1:553, 1:554f
 high-temperature stainless steels
 - chemical compositions 3:1874t
 - corrosion resistance 3:1873
 - halogen gas corrosion 3:1876
 - molten metal environments 3:1877
 - molten salt environments 3:1876
 - oxidation behaviors 3:1875, 3:1875f
 - sulfur attacks 3:1876
- hydrochloric acid (HCl) 2:1212f, 2:1213f
 hydrofluoric acid (HF) 2:1212f
 hydrogen embrittlement 2:920, 2:920f
 hydrogen sulfide (H₂S) environments 2:983f
 immersion tests/test compounds 3:1863, 3:1864t
 intergranular corrosion
 - anodic polarization curves 2:816f
 - general discussion 2:810
 - grain boundary attack susceptibility 2:813, 2:813f
 - grain boundary structure and network 2:812
 - grain dropping 2:811f
 - knife line attacks 2:818
 - metallurgical aspects 2:812
 - polarization curves 2:824f
 - sensitization conditions 2:815, 2:815f, 2:816f, 2:817f
 - sensitization prevention 2:817
 - standard practices and test methods 2:822t, 2:824f
 - theoretical aspects 2:811
 - time–temperature–precipitation (TTP) diagram 2:816, 2:817f, 2:818f
 - weld decay 2:818, 2:818f
- isothermal air behavior 1:591f
 marine corrosion 2:1125
 mechanical properties 3:2137t
 - cold work effects 3:1815, 3:1816f
 - fatigue properties 3:1816, 3:1816f, 3:1817t
 - general discussion 3:1812
 - room temperature conditions 3:1812, 3:1813t
 - stress–strain plots 3:1813f
 - tempering temperature effects 3:1814f
 - toughness impacts 3:1815, 3:1816f
- microstructure 3:1809f, 3:1811
 natural water environments
 - chlorination effects 3:1852, 3:1852f
 - drinking water 3:1853
 - freshwater 3:1853, 3:1854f
 - general discussion 3:1851
 - microbially-induced corrosion (MIC) 3:1851, 3:1852f
 - river waters 3:1853
 - seawater 3:1854, 3:1855t
- neural network method case study
 - carbonate concentration effects 2:1689f
 - chloride concentration effects 2:1688f
 - general discussion 2:1687
 - hydroxide concentration effects 2:1690f
 - nitrate concentration effects 2:1689f
 - sulfate concentration effects 2:1688f
 - temperature effects 2:1690f
- nitric acid (HNO₃) 2:1253
 nitridation processes 1:263f, 1:264f
 noble metal additions 3:2241t
 oxide overlay coatings 1:698f
 physical properties 3:1819, 3:1820t
 precipitation/embrittlement
 - carbide/nitride precipitation 3:1817
 - carburization 3:1818
 - 475°C embrittlement 3:1817
 - general discussion 3:1817
 - heat treatments 3:1818
 - intermetallic phases 3:1817
- primary uses 3:1807
 process equipment materials 4:3210–3211
 process industry applications
 - copper production 3:1862
 - corrosion resistance 3:1863
 - desalination 3:1863, 3:1865f
 - hydrometallurgy 3:1861
 - nickel production 3:1862
 - oil and gas production 3:1867, 3:1869
 - pulp and paper industry 3:1865
 - wastewater treatment 3:1870
 - zinc production 3:1862
- property relationships 3:1820
 refractory austenitic stainless steels 1:598t
 Schaeffler–Delong diagram 3:1811f
 seawater
 - anaerobic conditions 3:1857
 - cathodic protection 3:1856
 - exposure factors 3:1856, 3:1856a, 3:1857t
 - hydrogen embrittlement 3:1856
 - materials selection 3:1854, 3:1855f
 - polluted environments 3:1855
 - resistance factors 3:1854, 3:1855t
- spalling tendencies 1:591f
 steam and steam/hydrogen environments
 - construction materials 1:432t
 - general discussion 1:431
 - inner scale formation 1:443f
 - long-term behavior 1:436, 1:437f, 1:438f, 1:439f
 - oxidation rates 1:440f, 1:441f, 1:442f
 - pressure effects 1:449, 1:450f
 - scale growth rate 1:445, 1:445f
 - scale morphology 1:447f, 1:448f, 1:449f, 1:450f
 - spalling tendencies 1:439f
 - steam oxidation mechanisms 1:433, 1:434f, 1:435f
 - temperature dependence effects 1:440, 1:440f, 1:441f, 1:442f, 1:443f, 1:445f
 - time-based mass change 1:446f
 - void and gap formation 1:435, 1:436f, 1:437f, 1:438f, 1:439f
 - weight change comparisons 1:433f, 1:442f, 1:444f
- stress corrosion cracking (SCC) 2:867t, 2:872f, 3:1835, 4:3061f
 sulfuric acid (H₂SO₄) environments 2:1232f, 2:1235, 2:1237f
 surgical implants 2:1308
 thermal expansion coefficients 1:145f
 weight loss 1:592t
 - welding processes 3:2458, 3:2459f
- background information 3:1804
 below-water fastener selection 2:849f
 brazed joints 3:2451
 carbon dioxide (CO₂) environments 2:855f
 cathodic modification 3:2224–2249
 - background information 3:2226
 - basic concepts
 - active–passive state 3:2227, 3:2228f
 - active state 3:2227, 3:2228f
 - general discussion 3:2227
 - passive state 3:2227, 3:2228f

- stainless steels (*continued*)
 transpassive state 3:2228, 3:2228f
 chromium/chromium-based alloys
 general discussion 3:2230
 kinetic effects 3:2230
 noble metal additions 3:2230
 corrosion rates 3:2232r
 duplex stainless steels 3:2237, 3:2238t, 3:2239f, 3:2241r
 galvanic coupling 3:2237
 general discussion 3:2225
 iron–chromium (Fe–Cr) alloys 3:2231, 3:2235f
 iron–chromium–molybdenum (Fe–Cr–Mo) alloys 3:2233, 3:2234t, 3:2241
 iron–chromium–nickel–manganese (Fe–Cr–Ni–Mn) alloys 3:2236
 iron–chromium–nickel–molybdenum (Fe–Cr–Ni–Mo) alloys 3:2236
 nickel–iron–chromium (Ni–Fe–Cr) alloys 3:2235, 3:2240
 noble metal additions 3:2231
 passivation processes 3:2225, 3:2226f
 process mechanisms 3:2229
 schematic diagram 3:2227f
 surface alloying processes 3:2240, 3:2241r
 chemical compositions 2:1231t, 3:1810t, 3:1812t, 3:1825t, 3:1855t, 3:1863t, 3:1864t, 3:1874t
 chromium-containing alloys 1:583–605
 cast refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:603r
 compositions 1:597t, 1:598t
 general discussion 1:597
 growth behavior
 chromia (Cr₂O₃) growth 1:588
 high temperature corrosion protection 1:587
 spinel phase growth 1:588
 high temperature corrosion protection
 alloy types 1:584
 cobalt–chromium (Co–Cr) phase diagram 1:584, 1:586f
 growth behavior 1:587
 iron–chromium (Fe–Cr) phase diagram 1:584, 1:585f
 minor element influences 1:589
 nickel–chromium (Ni–Cr) phase diagram 1:584, 1:586f
 high temperature oxidation behavior
 austenitic stainless steels 1:591, 1:591f, 1:592f, 1:592t, 1:593f
 calculated partial pressures 1:590r
 cobalt–chromium (CoCr) alloys 1:593, 1:594f
 comparison studies 1:594, 1:594f, 1:595t, 1:596f, 1:597f
 general discussion 1:589
 global rating parameter (KB₄) 1:594, 1:596f
 martensitic and ferritic stainless steels 1:589, 1:590r
 metal loss/metal penetration studies 1:595t, 1:596f, 1:597f
 nickel–chromium (Ni–Cr) alloys 1:554f, 1:592, 1:593t
 nickel–iron–chromium (Ni–Fe–Cr) alloys 1:552f, 1:593, 1:593f, 1:594f
 solid oxygen fuel cell (SOFC) interconnectors 1:590r
 time to breakaway 1:590r
 weight gain 1:590f
 historical development 1:583
 iron–chromium (Fe–Cr) alloys 1:585f
 maximum isothermal service temperature 1:585f
 refractory austenitic stainless steels 1:598t
 refractory ferritic stainless steels 1:597r
 scaling index 1:584r
 wrought refractory cobalt–chromium (Co–Cr) alloys 1:602r
 wrought refractory iron–nickel–chromium (Fe–Ni–Cr) alloys 1:599t, 1:600r
 classifications 3:1808
 commercial applications
 art and architecture 3:1858f, 3:1866, 3:1867f, 3:1866f
 domestic products/kitchenware 3:1860, 3:1861t
 process industry
 copper production 3:1862
 corrosion resistance 3:1863
 desalination 3:1863, 3:1865f
 hydrometallurgy 3:1861
 nickel production 3:1862
 oil and gas production 3:1867
 pulp and paper industry 3:1865
 wastewater treatment 3:1870
 zinc production 3:1862
 corrosion fatigue 2:946, 2:946r
 corrosion properties
 alloy composition influence 3:1825, 3:1826f
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830f
 crevice formers 3:1850f
 critical crevice corrosion temperature (CCT) 3:1850f
 critical pitting temperature (CPT)
 alloying element influences 3:1829f
 basic concepts 3:1827
 grade resistance 3:1847, 3:1848f, 3:1849f
 photographic illustration 3:1829f
 potential dependence 3:1828f
 electrochemical reactions 3:1823, 3:1824f
 electrochemical testing methods 3:1846, 3:1847f
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845f
 general corrosion
 alkaline solutions 3:1843, 3:1844f
 characteristics 3:1838
 hydrochloric acid (HCl) 3:1840, 3:1840f
 nitric acid (HNO₃) 3:1842
 organic acids 3:1842, 3:1843f
 phosphoric acid (H₃PO₄) 3:1841, 3:1841f, 3:1842f
 sulfuric acid (H₂SO₄) 3:1838, 3:1839f, 3:1840f
 general discussion 3:1821
 grade resistance 3:1847, 3:1848f, 3:1849f, 3:1850f
 grade screening methods 3:1849, 3:1850f
 intergranular corrosion 3:1845, 3:1845f
 laboratory tests 3:1850
 localized corrosion 3:1824
 material selection tests 3:1849, 3:1851r
 passive films 3:1822, 3:1822f
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826f
 pitting potentials 3:1849f
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825t
 polarization curves 3:1824f
 postweld treatments 3:1837
 stress corrosion cracking (SCC)
 alkaline solutions 2:1200, 3:1833
 atmospheric environments 3:1834, 3:1835f
 characteristics 3:1830, 3:1831f
 chlorine-induced mechanisms 3:1832, 3:1832f
 film-induced cleavage 3:1831
 hydrogen embrittlement 3:1831
 hydrogen-induced stress cracking (HISC) 2:859, 2:859f, 3:1833
 laboratory tests 3:1850
 material selection tests 3:1849
 process mechanisms 3:1831
 slip dissolution 3:1831
 stress intensity factor–crack rate relationship 3:1832, 3:1832f
 sulfide stress cracking (SSC) 2:859, 2:859f, 2:860f, 3:1833
 welding-related corrosion 3:1836
 corrosion vulnerability data 4:2956t
 crevice corrosion
 characteristics 3:1829, 3:1830f
 corrosion test methods 2:1486, 2:1488f, 2:1488t, 2:1489f
 crevice initiation 2:1334–1335, 2:1335t, 2:1336f
 marine environments
 crevice corrosion 2:1126f, 2:1127f
 critical crevice corrosion solution values 2:1130r
 critical crevice corrosion temperature (CCT) 2:759, 2:759t, 2:1128, 2:1129t
 depth of localized attacks 2:1127r
 exposure factors 3:1857t
 general discussion 2:1125
 maximum depth of crevice attack 2:1128t
 pitting resistance number (PREN) 2:759, 2:759t, 2:1128–1129, 2:1129t
 304L 2:1126f, 2:1130t, 2:1131t
 316LVM 2:1127f, 2:1129t, 2:1130t, 2:1131t
 nitric acid (HNO₃) solutions 2:1257
 passive current density 2:1369f
 pitting corrosion 2:759, 2:759t, 2:795, 2:796f, 2:796t, 2:1334–1335, 2:1336f

- duplex stainless steels
 alkali corrosion 2:1199*f*, 2:1202*f*
 anhydrous hydrogen halide gases/hydrohalic acids 2:1212*f*
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*t*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 3:1858, 3:1858*t*
 cathodic modification 3:2237, 3:2238*t*, 3:2239*f*, 3:2241*t*
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1855*t*, 3:1863*t*,
 3:1864*t*, 3:1874*t*
 commercial applications
 art and architecture 3:1858*f*, 3:1866, 3:1867*f*, 3:1866*f*
 domestic products/kitchenware 3:1860, 3:1861*t*
 process industry 3:1861
 compositional ranges 3:1808*t*
 corrosion properties
 alloy composition influence 3:1825, 3:1826*f*
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830*f*
 crevice formers 3:1850*f*
 critical crevice corrosion temperature (CCT) 3:1850*f*
 critical pitting temperature (CPT) 3:1827, 3:1828*f*, 3:1829*f*, 3:1847,
 3:1848*f*, 3:1849*f*
 electrochemical reactions 3:1823, 3:1824*f*
 electrochemical testing methods 3:1846, 3:1847*f*
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845*f*
 general corrosion 3:1838
 general discussion 3:1821
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*, 3:1850*f*
 grade screening methods 3:1849, 3:1850*f*
 intergranular corrosion 3:1845, 3:1845*f*
 laboratory tests 3:1850, 3:1851*t*
 localized corrosion 3:1824
 material selection tests 3:1849, 3:1851*t*
 passive films 3:1822, 3:1822*f*
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826*f*
 pitting potentials 3:1849*f*
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825*t*
 polarization curves 3:1824*f*
 postweld treatments 3:1837
 stress corrosion cracking (SCC) 3:1830, 3:1831*f*
 welding-related corrosion 3:1837
 flow-induced corrosion 2:983*f*
 galvanic corrosion 2:849*f*, 2:853*t*, 2:855*f*
 general corrosion
 alkaline solutions 3:1843, 3:1844*f*
 characteristics 3:1838
 hydrochloric acid (HCl) 3:1840, 3:1840*f*
 nitric acid (HNO₃) 3:1842
 organic acids 3:1842, 3:1843*f*
 phosphoric acid (H₃PO₄) 3:1841, 3:1841*f*, 3:1842*f*
 sulfuric acid (H₂SO₄) 3:1838, 3:1839*f*, 3:1840*f*
 heat treatments
 general discussion 3:1818
 precipitation hardening 3:1819
 quenching 3:1818
 solution annealing 3:1818, 3:1818*t*
 stabilization annealing 3:1819
 tempering 3:1819
 high-temperature stainless steels
 chemical compositions 3:1874*t*
 corrosion resistance 3:1873
 halogen gas corrosion 3:1876
 molten metal environments 3:1877
 molten salt environments 3:1876
 oxidation behaviors 3:1875, 3:1875*f*
 sulfur attacks 3:1876
 hydrochloric acid (HCl) 2:1212*f*
 hydrogen sulfide (H₂S) environments 2:983*f*
 immersion tests/test compounds 3:1863, 3:1864*t*
 intergranular corrosion 2:818
 marine corrosion 2:1125
 mechanical properties
 cold work effects 3:1815, 3:1816*f*
 fatigue properties 3:1816, 3:1816*f*, 3:1817*t*
 general discussion 3:1812
 room temperature conditions 3:1812, 3:1813*t*
 stress-strain plots 3:1813*f*
 tempering temperature effects 3:1814*f*
 toughness impacts 3:1815, 3:1816*f*
 microstructure 3:1809*f*, 3:1811
 natural water environments
 chlorination effects 3:1852, 3:1852*f*
 drinking water 3:1853
 freshwater 3:1853, 3:1854*f*
 general discussion 3:1851
 microbially-induced corrosion (MIC) 3:1851, 3:1852*f*
 river waters 3:1853
 seawater 3:1854, 3:1855*t*
 physical properties 3:1819, 3:1820*t*
 precipitation/embrittlement
 carbide/nitride precipitation 3:1817
 carburization 3:1818
 475°C embrittlement 3:1817
 general discussion 3:1817
 heat treatments 3:1818
 intermetallic phases 3:1817
 primary uses 3:1807, 3:1807*f*
 process equipment materials 4:3210–3211
 process industry applications
 copper production 3:1862
 corrosion resistance 3:1863
 desalination 3:1863, 3:1865*f*
 hydrometallurgy 3:1861
 nickel production 3:1862
 oil and gas production 3:1867, 3:1869
 pulp and paper industry 3:1865
 wastewater treatment 3:1870
 zinc production 3:1862
 property relationships 3:1820
 Schaeffler–Delong diagram 3:1811*f*
 seawater
 anaerobic conditions 3:1857
 cathodic protection 3:1856
 exposure factors 3:1856, 3:1856*t*, 3:1857*t*
 hydrogen embrittlement 3:1856
 materials selection 3:1854, 3:1855*f*
 polluted environments 3:1855
 resistance factors 3:1854, 3:1855*t*
 stress corrosion cracking (SCC) 2:867*t*, 3:1836
 sulfuric acid (H₂SO₄) environments 2:1236*f*
 welding processes 3:2459
 economic aspects 4:3043, 4:3043*t*, 4:3044*f*, 4:3044*t*
 electrochemical scanning tunnel microscopy (ECSTM) 2:1436
 electroplated coatings 4:2578, 4:2587, 4:2590
 environmentally-assisted cracking 4:3208–3209
 erosion 3:1846
 erosion resistance 2:985*f*
 ferritic stainless steels
 acid pickling 4:2993*t*
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*t*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 3:1858, 3:1858*t*
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1855*t*, 3:1863*t*,
 3:1864*t*, 3:1874*t*
 chromia-forming alloys 1:424–425, 1:425*f*, 1:426*f*
 commercial applications
 art and architecture 3:1858*f*, 3:1866, 3:1867*f*, 3:1866*f*
 domestic products/kitchenware 3:1860, 3:1861*t*
 process industry 3:1861
 compositional ranges 3:1808*t*
 corrosion properties
 alloy composition influence 3:1825, 3:1826*f*
 alloying element influences 3:1822
 common test procedures 3:1846

- stainless steels (*continued*)
- corrosion fatigue 2:1258, 3:1836
 - crevice corrosion 3:1829, 3:1830*f*
 - crevice formers 3:1850*f*
 - critical crevice corrosion temperature (CCT) 3:1850*f*
 - critical pitting temperature (CPT) 3:1827, 3:1828*f*, 3:1829*f*, 3:1847, 3:1848*f*, 3:1849*f*
 - electrochemical reactions 3:1823, 3:1824*f*
 - electrochemical testing methods 3:1846, 3:1847*f*
 - erosion 3:1846
 - galvanic corrosion 3:1844, 3:1845*f*
 - general corrosion 3:1838
 - general discussion 3:1821
 - grade resistance 3:1847, 3:1848*f*, 3:1849*f*, 3:1850*f*
 - grade screening methods 3:1849, 3:1850*f*
 - intergranular corrosion 3:1845, 3:1845*f*
 - laboratory tests 3:1850
 - localized corrosion 3:1824
 - material selection tests 3:1849
 - passive films 3:1822, 3:1822*f*
 - passivity breakdown 3:1824
 - pitting corrosion 2:749, 3:1826, 3:1826*f*
 - pitting potentials 3:1849*f*
 - pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825*t*
 - polarization curves 3:1824*f*
 - postweld treatments 3:1837
 - stress corrosion cracking (SCC) 3:1830, 3:1831*f*
 - welding-related corrosion 3:1837
 - electrochemical potentiokinetic reactivation (EPR) test 2:1486
 - erosion resistance 2:985*f*
 - flow-induced corrosion 2:982*f*, 2:983*f*
 - galvanic corrosion 2:852*t*
 - general corrosion
 - alkaline solutions 3:1843, 3:1844*f*
 - characteristics 3:1838
 - hydrochloric acid (HCl) 3:1840, 3:1840*f*
 - nitric acid (HNO₃) 3:1842
 - organic acids 3:1842, 3:1843*f*
 - phosphoric acid (H₃PO₄) 3:1841, 3:1841*f*, 3:1842*f*
 - sulfuric acid (H₂SO₄) 3:1838, 3:1839*f*, 3:1840*f*
 - heat treatments
 - general discussion 3:1818
 - precipitation hardening 3:1819
 - quenching 3:1818
 - solution annealing 3:1818, 3:1818*t*
 - stabilization annealing 3:1819
 - tempering 3:1819
 - high temperature oxidation behavior 1:553, 1:554*f*
 - high-temperature stainless steels
 - chemical compositions 3:1874*t*
 - corrosion resistance 3:1873
 - halogen gas corrosion 3:1876
 - molten metal environments 3:1877
 - molten salt environments 3:1876
 - oxidation behaviors 3:1875, 3:1875*f*
 - sulfur attacks 3:1876
 - hydrogen sulfide (H₂S) environments 2:983*f*
 - immersion tests/test compounds 3:1863, 3:1864*t*
 - intergranular corrosion 2:818
 - marine corrosion 2:1125
 - mechanical properties
 - cold work effects 3:1815, 3:1816*f*
 - fatigue properties 3:1816, 3:1816*f*, 3:1817*t*
 - general discussion 3:1812
 - room temperature conditions 3:1812, 3:1813*t*
 - stress-strain plots 3:1813*f*
 - tempering temperature effects 3:1814*f*
 - toughness impacts 3:1815, 3:1816*f*
 - microstructure 3:1811
 - natural water environments
 - chlorination effects 3:1852, 3:1852*f*
 - drinking water 3:1853
 - freshwater 3:1853, 3:1854*f*
 - general discussion 3:1851
 - microbially-induced corrosion (MIC) 3:1851, 3:1852*f*
 - river waters 3:1853
 - seawater 3:1854, 3:1855*t*
 - nitric acid (HNO₃) 2:1253
 - noble metal additions 3:2241*t*
 - physical properties 3:1819, 3:1820*t*
 - polarization curves 2:1354, 2:1355*f*
 - precipitation/embrittlement
 - carbide/nitride precipitation 3:1817
 - carburization 3:1818
 - 475°C embrittlement 3:1817
 - general discussion 3:1817
 - heat treatments 3:1818
 - intermetallic phases 3:1817
 - primary uses 3:1807
 - process equipment materials 4:3210–3211
 - process industry applications
 - copper production 3:1862
 - corrosion resistance 3:1863
 - desalination 3:1863, 3:1865*f*
 - hydrometallurgy 3:1861
 - nickel production 3:1862
 - oil and gas production 3:1867, 3:1869
 - pulp and paper industry 3:1865
 - wastewater treatment 3:1870
 - zinc production 3:1862
 - property relationships 3:1820
 - Schaeffler–Delong diagram 3:1811*f*
 - seawater
 - anaerobic conditions 3:1857
 - cathodic protection 3:1856
 - exposure factors 3:1856, 3:1856*t*, 3:1857*t*
 - hydrogen embrittlement 3:1856
 - materials selection 3:1854, 3:1855*f*
 - polluted environments 3:1855
 - resistance factors 3:1854, 3:1855*t*
 - steam and steam/hydrogen environments
 - construction materials 1:432*t*
 - general discussion 1:431
 - inner scale formation 1:443*f*
 - long-term behavior 1:436, 1:437*f*, 1:438*f*, 1:439*f*
 - oxidation rates 1:440*f*, 1:441*f*, 1:442*f*
 - pressure effects 1:449, 1:450*f*
 - scale morphology 1:447*f*, 1:448*f*, 1:449*f*, 1:450*f*
 - spalling tendencies 1:439*f*
 - steam oxidation mechanisms 1:433, 1:434*f*, 1:435*f*
 - temperature dependence effects 1:440, 1:440*f*, 1:441*f*, 1:442*f*, 1:443*f*, 1:445*f*
 - void and gap formation 1:435, 1:436*f*, 1:437*f*, 1:438*f*, 1:439*f*
 - weight change comparisons 1:433*f*, 1:442*f*, 1:444*f*
 - stress corrosion cracking (SCC) 3:1835
 - thermal expansion coefficients 1:145*f*
 - welding processes 3:2458, 3:2459*f*
 - flow-induced corrosion 2:982*f*, 2:983*f*
 - formic acid environments 4:3060*f*
 - fracture toughness values 1:168*t*
 - fretting corrosion 2:1012–1013, 2:1012*f*, 2:1258
 - galvanic corrosion
 - basic concepts 3:1844
 - corrosion potential 3:1845*f*
 - corrosion rates 2:851*t*, 2:852*t*, 2:854*t*, 3:1757*t*
 - crevice corrosion depth 2:853*t*
 - environmental conditions 2:1011, 2:1012*f*
 - galvanic series 2:831*f*
 - marine environments 2:1119*f*
 - oil and gas industry 3:1868
 - glass linings and coatings 3:2324*t*
 - graphitic materials 3:2278
 - high-temperature corrosion 1:464, 1:466*f*, 1:466*t*, 1:467*f*, 1:468*f*
 - high-temperature stainless steels
 - chemical compositions 3:1874*t*
 - corrosion resistance 3:1873
 - halogen gas corrosion 3:1876
 - molten metal environments 3:1877
 - molten salt environments 3:1876
 - oxidation behaviors 3:1875, 3:1875*f*
 - sulfur attacks 3:1876

- historical development 1:583
hot-salt corrosion 1:474*f*, 1:477*f*
hydrogen embrittlement 2:1125, 3:1831, 3:1856
hydrogen sulfide (H₂S) environments 2:855*f*, 2:983*f*
immersion tests/test compounds 3:1863, 3:1864*t*
impressed current anodes 4:2783
intergranular corrosion
 anodic polarization curves 2:816*f*
 austenitic–ferritic (duplex) stainless steels 2:818
 characteristics 3:1845
 degree of sensitization tests 2:825*f*, 2:825*t*
 electrochemical potentiokinetic reactivation (EPR) tests 2:823, 2:825*f*, 2:825*t*
 ferritic stainless steels 2:818
 general discussion 2:815
 knife line attacks 2:818
 martensitic stainless steels 2:818
 polarization curves 2:824*f*
 precipitation hardenable stainless steels 2:819
 sensitization conditions 2:815, 2:815*f*, 2:816*f*, 2:817*f*
 sensitization prevention 2:817
 standard practices and test methods 2:822*t*, 2:824*f*
 time–temperature–precipitation (TTP) diagram 2:816, 2:817*f*, 2:818*f*
 time–temperature–sensitization (TTS) diagram 3:1845*f*
 weld decay 2:818, 2:818*f*
internal corrosion risks 4:3217*f*, 4:3218*f*
ionizing radiation corrosion
 chemical plant heating/cooling waters 2:1334, 2:1334*t*, 2:1335*f*
 corrosion potential 2:1334*t*
 current flow effects 2:1336*f*
 hydrogen peroxide (H₂O₂) effects 2:1334, 2:1335*f*
 light water reactors (LWRs) 2:1333
 nitric acid solutions 2:1337
 test considerations 2:1338
laser cladding (LC) 4:2624, 4:2633*t*
laser gas nitriding (LGS) 4:2632
laser surface alloying (LSA) 4:2631
marine corrosion
 crevice corrosion 2:1125, 2:1127*f*, 3:1857*t*
 critical crevice corrosion solution values 2:1130*t*
 critical crevice corrosion temperature (CCT) 2:759, 2:759*t*, 2:1128, 2:1129*t*
 depth of localized attacks 2:1127*t*
 maximum depth of crevice attack 2:1128*t*
 pitting corrosion 2:1125, 2:1131*t*
 pitting resistance number (PREN) 2:759, 2:759*t*, 2:1128–1129, 2:1129*t*
 stress corrosion cracking (SCC) 2:1125
martensitic stainless steels
 atmospheric environments
 general discussion 3:1858
 influencing factors 3:1860
 materials selection 3:1858, 3:1858*t*
 Sikla bridge (Sweden) 3:1858*f*
 urban/rural/marine atmospheres 3:1858, 3:1858*t*
 chemical compositions 3:1810*t*, 3:1812*t*, 3:1825*t*, 3:1855*t*, 3:1863*t*, 3:1864*t*, 3:1874*t*
 commercial applications
 art and architecture 3:1858*f*, 3:1866, 3:1867*f*, 3:1866*f*
 domestic products/kitchenware 3:1860, 3:1861*t*
 process industry 3:1861
 compositional ranges 3:1808*t*
 corrosion properties
 alloy composition influence 3:1825, 3:1826*f*
 alloying element influences 3:1822
 common test procedures 3:1846
 corrosion fatigue 2:1258, 3:1836
 crevice corrosion 3:1829, 3:1830*f*
 crevice formers 3:1850*f*
 critical crevice corrosion temperature (CCT) 3:1850*f*
 critical pitting temperature (CPT) 3:1827, 3:1828*f*, 3:1829*f*, 3:1847, 3:1848*f*, 3:1849*f*
 electrochemical reactions 3:1823, 3:1824*f*
 electrochemical testing methods 3:1846, 3:1847*f*
 erosion 3:1846
 galvanic corrosion 3:1844, 3:1845*f*
 general corrosion 3:1838
 general discussion 3:1821
 grade resistance 3:1847, 3:1848*f*, 3:1849*f*, 3:1850*f*
 grade screening methods 3:1849, 3:1850*f*
 intergranular corrosion 3:1845, 3:1845*f*
 laboratory tests 3:1850
 localized corrosion 3:1824
 material selection tests 3:1849
 passive films 3:1822, 3:1822*f*
 passivity breakdown 3:1824
 pitting corrosion 2:749, 3:1826, 3:1826*f*
 pitting potentials 3:1849*f*
 pitting resistance equivalent (PRE) value 3:1825–1826, 3:1825*t*
 polarization curves 3:1824*f*
 postweld treatments 3:1837
 stress corrosion cracking (SCC) 3:1830, 3:1831*f*
 welding-related corrosion 3:1836
 erosion resistance 2:985*f*
 fatigue resistance 3:1770*t*, 3:1771*f*
 flow-induced corrosion 2:983*f*
 general corrosion
 alkaline solutions 3:1843, 3:1844*f*
 characteristics 3:1838
 hydrochloric acid (HCl) 3:1840, 3:1840*f*
 nitric acid (HNO₃) 3:1842
 organic acids 3:1842, 3:1843*f*
 phosphoric acid (H₃PO₄) 3:1841, 3:1841*f*, 3:1842*f*
 sulfuric acid (H₂SO₄) 3:1838, 3:1839*f*, 3:1840*f*
 heat treatments
 general discussion 3:1818
 precipitation hardening 3:1819
 quenching 3:1818
 solution annealing 3:1818, 3:1818*t*
 stabilization annealing 3:1819
 tempering 3:1819
 high-temperature stainless steels
 chemical compositions 3:1874*t*
 corrosion resistance 3:1873
 halogen gas corrosion 3:1876
 molten metal environments 3:1877
 molten salt environments 3:1876
 oxidation behaviors 3:1875, 3:1875*f*
 sulfur attacks 3:1876
 hydrogen sulfide (H₂S) environments 2:983*f*
 immersion tests/test compounds 3:1863, 3:1864*t*
 intergranular corrosion 2:818
 marine corrosion 2:1125
 mechanical properties
 cold work effects 3:1815, 3:1816*f*
 fatigue properties 3:1816, 3:1816*f*, 3:1817*t*
 general discussion 3:1812
 room temperature conditions 3:1812, 3:1813*t*
 stress–strain plots 3:1813*f*, 3:1815*f*
 tempering temperature effects 3:1814*f*
 toughness impacts 3:1815, 3:1816*f*
 microstructure 3:1811
 natural water environments
 chlorination effects 3:1852, 3:1852*f*
 drinking water 3:1853
 freshwater 3:1853, 3:1854*f*
 general discussion 3:1851
 microbially-induced corrosion (MIC) 3:1851, 3:1852*f*
 river waters 3:1853
 seawater 3:1854, 3:1855*t*
 physical properties 3:1819, 3:1820*t*
 precipitation/embrittlement
 carbide/nitride precipitation 3:1817
 carburization 3:1818
 475°C embrittlement 3:1817
 general discussion 3:1817
 heat treatments 3:1818
 intermetallic phases 3:1817
 process equipment materials 4:3210–3211
 process industry applications
 copper production 3:1862
 corrosion resistance 3:1863
 desalination 3:1863, 3:1865*f*
 hydrometallurgy 3:1861
 nickel production 3:1862

- stainless steels (*continued*)
- oil and gas production 3:1867, 3:1869
 - pulp and paper industry 3:1865
 - wastewater treatment 3:1870
 - zinc production 3:1862
 - property relationships 3:1820
 - Schaeffler–Delong diagram 3:1811*f*
 - seawater
 - anaerobic conditions 3:1857
 - cathodic protection 3:1856
 - exposure factors 3:1856, 3:1856*t*, 3:1857*t*
 - hydrogen embrittlement 3:1856
 - materials selection 3:1854, 3:1855*f*
 - polluted environments 3:1855
 - resistance factors 3:1854, 3:1855*t*
 - steam and steam/hydrogen environments
 - construction materials 1:432*t*
 - general discussion 1:431
 - inner scale formation 1:443*f*
 - long-term behavior 1:436, 1:437*f*, 1:438*f*, 1:439*f*
 - oxidation rates 1:440*f*, 1:441*f*, 1:442*f*
 - pressure effects 1:449, 1:450*f*
 - scale morphology 1:447*f*, 1:448*f*, 1:449*f*, 1:450*f*
 - spalling tendencies 1:439*f*
 - steam oxidation mechanisms 1:433, 1:434*f*, 1:435*f*
 - temperature dependence effects 1:440, 1:440*f*, 1:441*f*, 1:442*f*, 1:443*f*, 1:445*f*
 - void and gap formation 1:435, 1:436*f*, 1:437*f*, 1:438*f*, 1:439*f*
 - weight change comparisons 1:433*f*, 1:442*f*, 1:444*f*
 - stress corrosion cracking (SCC) 2:867*t*, 3:1835
 - thermal expansion coefficients 1:145*f*
 - welding processes 3:2458
 - materials selection 4:3210, 4:3210*f*
 - mechanical properties
 - annealed alloys 3:1699*t*
 - cold work effects 3:1815, 3:1816*f*
 - fatigue properties 3:1816, 3:1816*f*, 3:1817*t*
 - general discussion 3:1812
 - room temperature conditions 3:1812, 3:1813*t*
 - stress–strain plots 3:1813*f*, 3:1815*f*
 - tempering temperature effects 3:1814*f*
 - toughness impacts 3:1815, 3:1816*f*
 - microstructure 3:1809*f*, 3:1811
 - molybdenum additives 3:2159
 - natural water environments
 - chlorination effects 3:1852, 3:1852*f*
 - drinking water 3:1853
 - freshwater 3:1853, 3:1854*f*
 - general discussion 3:1851
 - microbially-induced corrosion (MIC) 3:1851, 3:1852*f*
 - river waters 3:1853
 - seawater
 - anaerobic conditions 3:1857
 - cathodic protection 3:1856
 - exposure factors 3:1856, 3:1856*t*, 3:1857*t*
 - hydrogen embrittlement 3:1856
 - materials selection 3:1854, 3:1855*f*
 - polluted environments 3:1855
 - resistance factors 3:1854, 3:1855*t*
 - nitric acid (HNO₃)
 - containment materials 2:1253
 - corrosion-influencing factors
 - cold work 2:1260, 2:1260*f*
 - dissolved oxidizing species 2:1261, 2:1262*f*, 2:1263*f*
 - dissolved reducing species 2:1263, 2:1264*f*, 2:1265*t*
 - heat transfer 2:1266
 - ionizing radiation 2:1264, 2:1265*f*, 2:1266*f*
 - liquor-line corrosion effects 2:1267
 - nitrous acid gases 2:1260, 2:1261*f*
 - passive metals 2:1263
 - solution boiling 2:1265
 - vapor regions 2:1267
 - welds 2:1259, 2:1259*f*
 - corrosion mechanisms
 - corrosion fatigue 2:1258
 - corrosion rates 2:1256*f*
 - crevice corrosion 2:1257
 - end grain corrosion 2:1256*f*, 2:1257, 2:1257*f*
 - erosion 2:1258
 - fretting corrosion 2:1258
 - galvanic corrosion 2:1259
 - intragranular corrosion 2:1255, 2:1256*f*
 - passivity–transpassivity continuum 2:1255
 - stress corrosion cracking (SCC) 2:1258
 - corrosion rates 2:1253*t*, 2:1254*f*, 2:1256*f*
 - corrosion reactions 2:1252, 2:1253*f*
 - corrosion test methods
 - in-service corrosion rates 2:1267
 - ranking tests 2:1267
 - nitridation processes
 - basic concepts 1:260
 - corrosion mechanisms 1:262
 - predictive modeling 1:261*f*, 1:262
 - pressure effects 1:263*f*, 1:264*f*, 1:265*f*
 - thermochemistry 1:262
 - transition stages 1:265*f*
 - nuclear waste isolation 2:767
 - passive films 2:727, 2:744, 2:1436, 3:2195*t*
 - phase stability diagram 1:185, 1:185*f*
 - phosphoric acid (H₃PO₄) 4:2881, 4:2882*f*
 - physical properties 3:1699*t*, 3:1819, 3:1820*t*
 - pitting corrosion
 - characteristics 3:1826, 3:1826*f*
 - crevice corrosion 2:759, 2:795, 2:796*f*, 2:796*t*, 2:1334–1335, 2:1336*f*
 - critical crevice corrosion temperature (CCT) 3:1850*f*
 - critical pitting temperature (CPT)
 - alloying additions 2:759
 - alloying element influences 3:1829*f*
 - basic concepts 2:797, 2:797*f*, 3:1827
 - grade resistance 3:1847, 3:1848*f*, 3:1849*f*
 - photographic illustration 3:1829*f*
 - potential dependence 3:1828*f*
 - electrochemical behavior 3:2107*f*
 - marine environments 2:1125, 2:1131*t*
 - pit chemistry 3:1826*f*
 - pitting potentials 3:1849*f*
 - pitting-producing anions 2:774*t*
 - precipitation/embrittlement
 - carbide/nitride precipitation 3:1817
 - carburization 3:1818
 - 475°C embrittlement 3:1817
 - general discussion 3:1817
 - heat treatments
 - general discussion 3:1818
 - precipitation hardening 3:1819
 - quenching 3:1818
 - solution annealing 3:1818, 3:1818*t*
 - stabilization annealing 3:1819
 - tempering 3:1819
 - intermetallic phases 3:1817
 - precipitation hardenable stainless steels
 - compositional ranges 3:1808*t*
 - intergranular corrosion 2:819
 - marine corrosion 2:1125
 - process equipment materials 4:3210–3211
 - preservative treatments 2:1327–1328
 - primary uses 3:1807, 3:1807*f*, 3:1807*t*, 3:1860
 - property relationships 3:1820
 - quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2244
 - reducing environments 1:465
 - scale failure strain measurements 1:167*t*
 - Schaeffler–Delong diagram 3:1811, 3:1811*f*
 - S–N (stress–number of cycles to failure) curves 2:930*f*
 - soil corrosion 2:1158, 2:1158*t*, 2:1165*t*
 - standard reduction potential 3:2074*t*
 - storage tanks
 - electroless nickel plating baths 4:2887
 - phosphoric acid (H₃PO₄) 4:2887
 - sulfuric acid (H₂SO₄) 4:2886, 4:2887, 4:2887*f*, 4:2888*f*
 - stress corrosion cracking (SCC)
 - alkaline solutions 2:1200, 3:1833
 - atmospheric environments 3:1834, 3:1835*f*
 - characteristics 3:1830, 3:1831*f*
 - chlorine-induced mechanisms 3:1832, 3:1832*f*

- film-induced cleavage 3:1831
 highly corrosive environments 3:1822*f*
 hydrogen embrittlement 3:1831
 hydrogen-induced stress cracking (HISC) 2:859, 2:859*f*, 3:1833
 laboratory tests 3:1850
 marine environments 2:1125
 material selection tests 3:1849
 metal–environment combinations 2:867*t*
 nitric acid (HNO₃) solutions 2:1258
 performance predictions 4:3058*f*
 process mechanisms 3:1831
 slip dissolution 3:1831
 stress intensity factor–crack rate relationship 3:1832, 3:1832*f*
 sulfide stress cracking (SSC) 2:859, 2:859*f*, 2:860*f*, 3:1833
 stress growth measurements 1:159*t*
 sulfate-reducing bacteria (SRB) 2:1175, 2:1176, 2:1177*f*, 2:1178*f*
 sulfuric acid (H₂SO₄)
 anodic polarization curves 2:1231*f*, 2:1236*f*
 austenitic stainless steels 2:1232*f*, 2:1235, 2:1237*f*
 chromium alloying influences 2:1232–1233, 2:1233*f*
 compositions 2:1231*t*
 contaminant effects 2:1234, 2:1235*f*
 copper alloying influences 2:1232–1233, 2:1233*f*
 corrosion rates 4:2878, 4:2879*f*
 ferritic chromium steels 2:1231*f*
 molybdenum alloying influences 2:1232–1233, 2:1233*f*
 nickel alloying influences 2:1232–1233, 2:1233*f*
 oxidizing environments 2:1233–1234, 2:1234*f*
 passivation current density 4:2879*f*
 passive range 4:2879*f*
 performance characteristics 2:1235, 2:1236*f*, 2:1237*f*, 2:1238*f*
 polarization curves 2:1354, 2:1355*f*
 protection mechanisms 2:1230
 silicon alloying influences 2:1232–1233
 temperature effects 2:1236*f*
 velocity factors 2:1234, 2:1236*f*
 surgical implants
 corrosion resistance 2:764, 2:1314
 environmental conditions 2:1311
 health effects 2:1310
 historical background 2:1308
 thermal expansion coefficients 1:145*f*
 thiocyanate compounds 4:2883
 304L
 acetic acid–sodium chloride mixtures 4:3059*t*
 active–passive transition state 2:1617–1618, 2:1617*f*
 alkali corrosion 2:1198*f*, 2:1199*f*, 2:1200*f*
 corrosion potential 2:1334*t*
 crevice corrosion 2:1126*f*, 2:1487–1488, 2:1488*t*
 crevice initiation 2:1334–1335, 2:1335*t*, 2:1336*f*
 critical crevice corrosion solution values 2:1130*t*
 formic acid environments 4:3060*f*
 galvanic corrosion 2:855*f*, 2:1011, 2:1012*f*, 2:1478, 2:1480*t*, 3:1757*t*
 hydrofluoric acid (HF) corrosion 2:1211*t*, 2:1212*f*
 hydrogen peroxide (H₂O₂) effects 2:1334, 2:1335*f*
 intergranular corrosion testing procedures 2:825*t*, 2:826
 laser surface alloying (LSA) 4:2631
 marine corrosion 2:1125, 2:1128*t*
 nanocrystalline alloys 3:2202
 nitridation processes 1:264*f*
 nuclear waste isolation 2:767
 physical properties 3:2096*t*
 pitting corrosion 2:1131*t*
 stress corrosion cracking (SCC) 2:1333
 sulfuric acid (H₂SO₄) environments 2:1232*f*, 2:1235, 2:1238*f*
 316LVM
 above-water fastener selection 2:847*f*
 acetic acid–sodium chloride mixtures 4:3059*t*
 alkali corrosion 2:1198*f*, 2:1199*f*, 2:1200*f*
 below-water fastener selection 2:849*f*
 corrosion resistance 2:764, 2:1314, 3:2240
 crevice corrosion 2:1125, 2:1317
 critical crevice corrosion solution values 2:1130*t*
 formic acid environments 4:3060*f*
 galvanic corrosion 2:852*t*, 2:855*f*, 2:1478, 2:1480*t*, 3:1757*t*
 hydrofluoric acid (HF) corrosion 2:1211*t*, 2:1219*f*
 laser surface alloying (LSA) 4:2631
 marine corrosion 2:849*f*, 2:1127*f*, 2:1128*t*
 nuclear waste isolation 2:767
 pitting corrosion 2:1131*t*, 2:1317
 pitting resistance number (PREN) 2:1129*t*
 repassivation potential 2:1623–1624, 2:1623*f*
 sulfuric acid (H₂SO₄) environments 2:1235, 2:1235*f*, 2:1237*f*, 2:1238*f*, 2:1247*f*
 tank transport studies 3:1912
 zirconium (Zr)-based bulk metallic glasses 3:2200
 welding processes
 austenitic stainless steels 3:2458, 3:2459*f*
 common corrosion sites 3:2458*f*
 duplex stainless steels 3:2459
 ferritic stainless steels 3:2458, 3:2459*f*
 general discussion 3:2458
 localized corrosion 3:2460
 martensitic stainless steels 3:2458
 sensitization conditions 3:2460, 3:2460*f*
 standard chemical potential 1:5
 standards
 advanced technical ceramics 3:2286, 3:2288
 cathodic protection 4:2754, 4:2754*t*
 cement 3:2349
 corrosion monitoring and inspection 4:3117–3166
 crevice corrosion tests 2:760
 glass-lined steel equipment manufacturing processes 3:2322, 3:2322*t*, 3:2323*t*
 hot-dipped coatings
 ASTM standards 4:2574*t*
 EN/ISO standards 4:2573*t*
 general discussion 4:2573
 intergranular corrosion testing procedures
 aluminum alloys 2:821*t*
 degree of sensitization tests 2:823, 2:825*f*, 2:825*t*
 electrochemical potentiokinetic reactivation (EPR) tests 2:823, 2:825*f*, 2:825*t*
 general discussion 2:820
 microstructure screening 2:823
 nickel/nickel alloys 2:823*t*, 2:825*t*
 stainless steels 2:822*t*, 2:824*f*
 metallic cultural heritage preservation 4:3309
 paint inspections
 chemical cleanliness 4:2725
 post-paint application monitoring 4:2726
 surface preparation 4:2723
 surface profile 4:2724
 risk-based inspection (RBI) 4:3238–3239
 surface pretreatments 4:2493
 star cracking 4:2739
 statistical analysis 2:1547–1580
 analytical methods
 Bayes' theory
 Bayes' theorem 2:1557
 general discussion 2:1557
 prior and posterior possibilities 2:1558
 prior predictive possibility 2:1558
 probability theories 2:1557
 robust Bayes method 2:1559
 specifying the prior 2:1558
 uninformative prior possibility 2:1558
 wall thickness measurements 2:1569
 experimental designs 2:1556
 extreme value (EV) distributions
 basic concepts 2:1554
 chloride concentration variations 2:1572*f*
 coupon testing 2:1560, 2:1562*f*
 pit depth measurements 2:1570, 2:1571*f*
 wall thickness measurements 2:1567, 2:1569*f*
 general discussion 2:1550
 linear regression 2:1553, 2:1560, 2:1560*f*, 2:1567
 Monte Carlo (MC) techniques 2:1550*f*
 Normal (Gaussian) distributions 2:1550, 2:1550*f*, 2:1552*f*
 Poisson process modeling 2:1553, 2:1576*t*
 sampling theory/sample surveys 2:1556
 threshold techniques 2:1555, 2:1577, 2:1578*f*
 Wiener process modeling 2:1555

- statistical analysis (*continued*)
 background information 2:1549
 corrosion studies
 corrosion engineering
 general discussion 2:1565
 heat exchanger tube inspections 2:1565
 inspection and repair optimization 2:1574
 Intelligent Pig pipeline inspections 2:1573
 pit depth measurements 2:1570
 thickness measurement locations 2:1566
 corrosion monitoring
 general discussion 2:1577
 threshold techniques 2:1555, 2:1577, 2:1578*f*
 corrosion science
 coupon testing 2:1559
 crack depth modeling 2:1563
 induction time measurements 2:1559
 pitting potentials 2:1559, 2:1559*f*
 coupon testing
 analysis of variance 2:1561*t*
 extreme value (EV) analysis 2:1560, 2:1562*f*
 general discussion 2:1559
 linear polarization resistance measurements (LPRMs) 2:1562, 2:1563*f*
 pit depth measurements 2:1560, 2:1561*f*, 2:1562*f*
 response surface regression analysis 2:1562, 2:1563*f*
 straight line regression models 2:1560, 2:1560*f*
 weight loss 2:1560, 2:1560*f*
 crack depth inspections
 case studies 2:1575
 inspection and repair optimization 2:1574
 inspection interval—operational failure rate plot 2:1577*f*
 parameter estimates 2:1576*t*
 probability density distribution 2:1576*f*
 time—crack depth plot 2:1576*f*
 heat exchanger tube inspections
 basic concepts 2:1565
 pit depth measurements 2:1565*f*, 2:1566*f*
 inspection and repair optimization
 crack depth inspections 2:1574, 2:1576*f*
 failure costs 2:1575
 general discussion 2:1574
 Intelligent Pig pipeline inspections
 general discussion 2:1573
 tracked feature depths 2:1573, 2:1574*f*
 untracked features/pareto distribution analysis 2:1573, 2:1573*f*
 pit depth measurements
 chloride concentration variations 2:1572*f*
 coupon testing 2:1560, 2:1561*f*, 2:1562*f*
 extreme value (EV) analysis 2:1570, 2:1571*f*
 general discussion 2:1570
 heat exchanger tube inspections 2:1565*f*, 2:1566*f*
 life prediction models 2:1570, 2:1571*f*
 straight line regression models 2:1571, 2:1572*f*
 thickness measurement locations
 Bayesian methods 2:1569
 extreme value (EV) analysis 2:1567, 2:1568*t*, 2:1569*f*
 general discussion 2:1566
 straight line regression models 2:1567
 ultrasonic wall thickness measurements 2:1568*t*
 wall thickness data 2:1567*f*, 2:1568*f*
 general discussion 2:1579
 steam and steam/hydrogen environments 1:407–456
 argon–water vapor (Ar–H₂O) atmospheres 1:408, 1:410*f*, 1:412*f*
 basic concepts 1:408
 metallic high-temperature components
 alumina-forming alloys and coatings
 alumina scale formation 1:449, 1:450*f*, 1:451*f*, 1:452*f*
 borderline alumina-forming alloys 1:452, 1:452*f*, 1:453*f*
 metastable alumina 1:451
 borderline alloys 1:426
 chromium/chromium-based alloys 1:418
 chromia (Cr₂O₃) scale growth mechanisms 1:419, 1:421*f*
 chromia-forming iron- and nickel-based alloys 1:418, 1:420*f*
 commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422*f*, 1:423*f*
 minor alloying element addition effects 1:423, 1:424*f*, 1:425*f*, 1:426*f*
 oxidation processes 1:418
 spalling tendencies 1:419*f*
 surface morphologies 1:423*f*
 weight change comparisons 1:419*f*, 1:420*f*
 environmental conditions
 breakaway oxidation mechanisms 1:428*f*, 1:430
 external chromia scale formation 1:427, 1:429*f*
 internal oxidation 1:427, 1:428*f*
 nonprotective oxidation 1:426
 ferritic and austenitic stainless steels
 construction materials 1:432*t*
 general discussion 1:431
 inner scale formation 1:443*f*
 long-term behavior 1:436, 1:437*f*, 1:438*f*, 1:439*f*
 oxidation rates 1:440*f*, 1:441*f*, 1:442*f*
 pressure effects 1:449, 1:450*f*
 scale growth rate 1:445, 1:445*f*
 scale morphology 1:447*f*, 1:448*f*, 1:449*f*, 1:450*f*
 spalling tendencies 1:439*f*
 steam oxidation mechanisms 1:433, 1:434*f*, 1:435*f*
 temperature dependence effects 1:440, 1:440*f*, 1:441*f*, 1:442*f*, 1:443*f*, 1:445*f*
 time-based mass change 1:446*f*
 void and gap formation 1:435, 1:436*f*, 1:437*f*, 1:438*f*, 1:439*f*
 weight change comparisons 1:433*f*, 1:442*f*, 1:444*f*
 general discussion 1:416
 nomenclature 1:417
 protective scale-forming elements (PSEs) 1:416, 1:417*f*
 nomenclature 1:408
 oxide scale growth
 lattice diffusion 1:415
 molecular diffusion 1:415, 1:416*f*, 1:417*f*
 oxidation rate–hydration enthalpy relationship 1:415*f*
 surface reaction kinetics 1:413, 1:414*f*
 thermodynamics
 argon–water vapor (Ar–H₂O) atmospheres 1:410*f*, 1:412*f*
 equilibrium oxygen partial pressure 1:409*f*, 1:410*f*, 1:412*f*
 gas atmospheres 1:409, 1:409*f*, 1:410*f*
 material testing considerations 1:411, 1:412*f*, 1:413*f*
 solid oxide stability 1:409
 temperature dependence effects 1:411*f*
 volatile reaction products 1:409, 1:411*f*
 uranium compounds 3:2188
 vitreous silica 3:2315
 steam boiler systems 4:2971–2989
 boiler water treatment
 all-polymer treatments 4:2982
 all volatile treatment (AVT) 4:2985
 caustic treatment 4:2986
 chelant treatments 4:2981
 congruent phosphate treatment 4:2983
 coordinated phosphate treatment 4:2982, 4:2983*f*
 equilibrium phosphate treatment 4:2984, 4:2985*f*
 residual phosphate treatment 4:2980, 4:2981*t*
 steam purity 4:2980
 chemical inhibitors 4:2961
 condensate treatment 4:2986
 crevice corrosion 2:766
 drum-type utility boiler 4:2974*f*
 feedwater treatment
 all volatile treatment (oxidizing) (AVT(O)) 4:2978
 all volatile treatment (reducing) (AVT(R)) 4:2977
 dissolved oxygen control 4:2975, 4:2976*t*
 flow accelerated corrosion (FAC) 4:2977
 general discussion 4:2975
 oxygenated treatment (OT) 4:2979
 oxygen scavengers 4:2975, 4:2976*t*
 pH control 4:2977
 field-erected water tube industrial boiler 4:2973*f*
 industry guidelines 4:2971
 makeup water treatment 4:2973
 mineral scales, muds, and sludges 4:2941, 4:2942*f*
 out-of-service conditions 4:2988
 process equipment risk management 4:3217*f*
 sampling guidelines 4:2988
 water system schematic diagram 4:2972*f*

- steamed European beech 2:1325r
 steam-turbine lubricants 2:1305
 stearic acid 3:1795, 3:1842
 Stearn–Geary equation 2:1466, 2:1469
 steel 3:1693–1736
 acid pickling
 chemical cleaning 4:2489
 hydrochloric acid (HCl) 4:2992r
 hydrofluoric acid (HF) 4:2993r
 nitric acid (HNO₃) 4:2993r
 phosphoric acid (H₃PO₄) 4:2993r
 sulfuric acid (H₂SO₄) 4:2992r
 adhesive bond failure 3:2472f
 aircraft corrosion
 design guidelines 4:3191r
 materials selection 4:3182
 protective treatments 4:3186, 4:3187f
 reprotective treatments 4:3194r
 alkali corrosion
 anodic polarization curves 2:1194f
 corrosion rates 2:1196f
 crevice corrosion 2:1194–1195, 2:1195f
 general discussion 2:1192
 iron–water system Pourbaix diagram 2:1193f
 stress relief techniques 2:1194f
 temperature effects 2:1194f, 2:1195f
 aluminized steel 4:3043, 4:3043r, 4:3044r
 anhydrous hydrogen halide gases/hydrohalic acids
 corrosion rates
 general discussion 2:1209
 hydrochloric acid (HCl) 2:1209f
 hydrofluoric acid (HF) 2:1210f, 2:1212f
 aqueous corrosive environments 4:2748, 4:2748f, 4:2749f, 4:2750f, 4:2751f
 atmospheric corrosion
 atmospheric corrosivity classifications 3:1725, 3:1726t, 3:1727r
 corrosion kinetics
 climatic variation 3:1720, 3:1721r
 corrosion rates 3:1722, 3:1722f, 3:1723r
 exposure conditions 3:1721
 corrosion mechanisms
 acid regeneration cycle 3:1718
 electrochemical mechanisms 3:1719
 wet/dry cycles 3:1719, 3:1720f
 corrosion product composition 3:1719
 electrochemical effects 2:1088
 environmental influences
 air-borne pollutants 3:1715, 3:1715t, 3:1716f
 particulate matter 3:1715f, 3:1717, 3:1718r
 relative humidity (RH) 3:1714, 3:1715f, 3:1715r
 sea salt 3:1718r
 urban/rural/marine atmospheres 2:848f
 weathering steels
 alloying effects 3:1720f, 3:1722f, 3:1723, 3:1724f
 applications 3:1724
 next generation weathering steels 3:1725, 3:1725r
 wet/dry cycles 3:1723, 3:1725f
 brazed joints 3:2451
 carbon dioxide (CO₂) environments 2:855f
 carbon steel 3:1693–1736
 above-water fastener selection 2:847f
 acetic acid–sodium chloride mixtures 4:3059r
 acid corrosion 3:1792, 3:1792r
 adhesive bond failure 3:2473, 3:2473f, 3:2475f, 3:2476f, 3:2477f
 alkali corrosion
 anodic polarization curves 2:1194f
 corrosion rates 2:1196f
 crevice corrosion 2:1194–1195, 2:1195f
 general discussion 2:1192
 iron–water system Pourbaix diagram 2:1193f
 stress relief techniques 2:1194f
 temperature effects 2:1194f, 2:1195f
 ammonia damage 4:3220r
 ammonium nitrate (NH₄NO₃) 4:2883
 anhydrous hydrogen halide gases/hydrohalic acids 2:1209f
 aqueous corrosion
 corrosion rates 3:1761f
 crevice corrosion 3:1711
 differential aeration cell corrosion 3:1710, 3:1710f
 erosion-corrosion 3:1712
 flow-assisted corrosion 3:1712
 galvanic corrosion 3:1711, 3:1757r
 general corrosion 3:1710
 pitting corrosion 3:1711
 protective treatments 3:1713
 solubility products 3:1712r
 tuberculation corrosion 3:1710f
 atmospheric corrosion
 acid regeneration cycle 3:1718
 air-borne pollutants 3:1715, 3:1715t, 3:1716f
 alloying effects 3:1720f, 3:1722f, 3:1723, 3:1724f
 atmospheric corrosivity classifications 3:1725, 3:1726t, 3:1727r
 climatic variation 3:1720, 3:1721r
 corrosion kinetics 3:1720
 corrosion mechanisms 3:1718
 corrosion product composition 3:1719
 corrosion rates 3:1722, 3:1722f, 3:1723r
 electrochemical mechanisms 3:1719
 environmental influences 3:1714
 exposure conditions 3:1721
 next generation weathering steels 3:1725, 3:1725r
 particulate matter 3:1715f, 3:1717, 3:1718r
 relative humidity (RH) 3:1714, 3:1715f, 3:1715r
 sea salt 3:1718r
 urban/rural/marine atmospheres 2:848f
 weathering steels 3:1723, 3:1724
 wet/dry cycles 3:1719, 3:1720f, 3:1723, 3:1725f
 below-water fastener selection 2:849f
 brazed joints 3:2451
 carbon dioxide (CO₂) environments 2:855f
 cathodic protection criteria 4:2847r
 chlorine-related corrosion 1:479f
 corrosion fatigue 2:944
 corrosion processes
 aqueous corrosion 3:1710
 corrosion products 3:1709r
 environmentally-assisted cracking 3:1712
 general discussion 3:1709
 high-temperature oxidation 3:1713
 hydrogen embrittlement 3:1713
 microbially-induced corrosion (MIC) 3:1713
 corrosion rates
 hydrochloric acid (HCl) 2:1209f, 3:1765r
 hydrofluoric acid (HF) 2:1210f, 2:1212f
 marine environments 2:1114f, 3:1761f
 sulfuric acid (H₂SO₄) 3:1792, 3:1792t, 4:2876, 4:2878f
 electrochemical effects 2:1088
 electrochemistry
 anodic dissolution 3:1704
 aqueous corrosive environments 3:1708
 cathodic reactions 3:1707
 passivity 3:1705
 potential–pH (Pourbaix) diagram 3:1702, 3:1703f, 3:1706f
 thermodynamics 3:1702
 environmentally-assisted cracking 4:3217f, 4:3218f
 erosion resistance 2:985f
 galvanic corrosion 2:1011, 2:1013f
 high-temperature oxidation 1:466f
 historical background 3:1695
 hydrogen sulfide (H₂S) damage 4:3219f
 hydrogen sulfide (H₂S) environments 2:855f
 iron–carbon (Fe–C) alloys
 equilibrium microstructures 3:1697, 3:1698f
 mechanical properties 3:1699, 3:1699r
 nonequilibrium microstructures 3:1697, 3:1698f
 phase diagram 3:1695, 3:1696f
 physical properties 3:1699, 3:1699r
 marine corrosion
 alloying element influences 3:1702f, 3:1702r
 corrosion profile 2:1121f
 corrosion rates 2:1114f, 2:1120, 2:1121t, 3:1761f
 design-based mitigation 4:3080f
 exposure rate–dissolved oxygen plot 2:1124f
 exposure rate–seawater depth plot 2:1124f
 hydrogen embrittlement 2:1123–1124

- steel (*continued*)
- mass loss 2:1122^f
 - pitting corrosion 2:1122–1123, 2:1122^f, 2:1123^f
 - polarization curves 2:1114^f, 2:1120^f
 - protective treatments 2:1143
 - seawater velocity effects 2:1122^f
 - materials selection 4:3210, 4:3210^f
 - molybdenum additives 3:2159
 - oil and gas industry facilities 4:3234
 - passivation current density 4:2876^f, 4:2877^f
 - passive range 4:2877^f
 - phosphoric acid (H₃PO₄) 4:2881
 - potentiodynamic curves 4:2876^f
 - processing techniques
 - alloying element influences 3:1702^f, 3:1702^t
 - corrosion rates 3:1700, 3:1701^t, 3:1702^t
 - marine corrosion resistance 3:1702^t
 - mechanical deformation 3:1700, 3:1701^f
 - protective barrier inducement (PBI) 4:2898^f, 4:2899^f
 - reducing environments 1:468^f
 - scale inhibitors/dispersants 4:2993^t
 - S–N (stress–number of cycles to failure) curves 2:930^f
 - soil corrosion 2:1152^f, 2:1157, 2:1157^f
 - storage tanks
 - alkaline environments 4:2888
 - cellulose boilers 4:2888
 - liquid fertilizer storage tanks 4:2888
 - sulfuric acid (H₂SO₄) 4:2887
 - stress corrosion cracking (SCC) 2:867^t, 2:871^f, 4:3058^f
 - sulfidation corrosion 1:241^f, 1:246^f
 - sulfuric acid (H₂SO₄) environments 2:1236^f, 2:1238^f, 4:3058^f
 - sweet corrosion 4:3291
 - underground corrosion
 - buried steel 3:1732
 - controlling factors 3:1731, 3:1732^t
 - long-term burial 3:1733
 - pilings 3:1732
 - pipelines 3:1733
 - water corrosion
 - accelerated low water corrosion (ALWC) 3:1729
 - boiler waters 3:1731
 - deposits and scales 3:1728
 - dissolved gases 3:1726
 - dissolved solids 3:1727
 - fouling deposits 3:1728
 - heating and cooling systems 3:1730, 3:1731^t
 - height-related corrosion 3:1730, 3:1731^f
 - microbial effects 3:1728
 - natural waters 3:1728, 3:1729^t
 - piped fresh water systems 3:1729, 3:1730^t
 - process waters 3:1730
 - under-deposit corrosion 3:1728
 - unprotected structural steel 3:1729
 - water composition 3:1726
 - wear effects 1:393^f
 - welding processes 3:2456, 3:2457^f
- cathodic protection 4:2753, 4:2754^t, 4:2774, 4:2774^t, 4:2775^t
- concrete degradation
- carbonation 3:2359, 3:2359^f
 - cathodic protection 4:2755, 4:2812^t, 4:2827, 4:2830^f
 - characteristics 3:2358
 - chloride-induced corrosion 3:2359, 3:2359^f
 - chloride ion diffusion 3:2359
 - chloride ion selective electrodes 3:2362
 - chloride ion sources 3:2359
 - corrosion inhibitors 4:2996
 - corrosion ladder 3:2361
 - diffusion cell test 3:2360
 - immersion tests 3:2360
 - resistivity tests 3:2360
 - retrieved sample tests 3:2361
 - testing errors 3:2361
- copper steel 3:1724^f
- corrosion potential 4:2591^t
- corrosion processes
- aqueous corrosion
 - crevice corrosion 3:1711
 - differential aeration cell corrosion 3:1710, 3:1710^f
 - erosion-corrosion 3:1712
 - flow-assisted corrosion 3:1712
 - galvanic corrosion 3:1711, 3:1757^t
 - general corrosion 3:1710
 - pitting corrosion 3:1711
 - protective treatments 3:1713
 - solubility products 3:1712^t
 - tuberculation corrosion 3:1710^f
 - corrosion products 3:1709^t
 - environmentally-assisted cracking 3:1712
 - general discussion 3:1709
 - high-temperature oxidation 3:1713
 - hydrogen embrittlement 3:1713
 - microbially-induced corrosion (MIC) 3:1713
 - corrosion protection methods
 - marine environments 2:1143
 - paints and organic coatings
 - anodic reactions 4:2669
 - cathodic reactions 4:2667
 - oxygen diffusion 4:2668, 4:2668^t
 - water diffusion 4:2668, 4:2668^t
 - corrosion vulnerability data 4:2956^t
 - corrosivity 1:90
 - economic aspects 4:3043, 4:3043^t, 4:3044^f, 4:3044^t
 - electrochemistry
 - anodic dissolution
 - anion adsorption effects 3:1704
 - oxygen-containing conditions 3:1704
 - oxygen-free conditions 3:1704
 - aqueous corrosive environments
 - anode and cathode separation 3:1708, 3:1708^f
 - flow rate effects 3:1708
 - mass transport processes 3:1708
 - cathodic reactions
 - hydrogen evolution reactions 3:1707
 - oxygen reduction reactions 3:1707
 - passivity
 - nonoxide passive films 3:1706
 - passive oxide films 3:1705
 - potential–pH (Pourbaix) diagram 3:1702, 3:1703^f, 3:1706^f
 - thermodynamics 3:1702
 - electroplated coatings 4:2578
 - ferritic chromium steels
 - anodic polarization curves 2:1231^f
 - flow-induced corrosion 2:982^f
 - metal dusting 1:291, 1:292^f, 1:293^f
 - solid oxide fuel cells (SOFCs)
 - alloying elements 1:494^t
 - anode gas effects 1:494, 1:496^f, 1:497^f
 - anode-side interactions 1:510, 1:511^f, 1:512^f
 - carbonaceous gas formation 1:497, 1:498^f
 - cathode-side interactions 1:507, 1:508^f
 - characteristics 1:492
 - component thickness effects 1:502, 1:503^f, 1:504^f, 1:505^f
 - compositions 1:501^t
 - contact resistance 1:501^f
 - design guidelines 1:499
 - dual atmosphere conditions 1:507
 - metal–glass sealant interactions 1:512, 1:513^f
 - oxidation rates 1:500^f
 - oxide scale formation 1:495^f, 1:496^f, 1:501^f, 1:506^f
 - temperature dependence effects 1:502^f
 - vaporization protection methods 1:509, 1:510^f, 1:511^f
 - filiform corrosion 2:1000, 2:1001^f, 2:1002^f
 - fireside corrosion 1:466^f, 1:468^f
 - flow-induced corrosion 2:982^f
 - galvanic corrosion 2:831^f, 2:1119^f
 - galvanized steel 2:1165, 2:1166^f
 - galvanizing process
 - alloying additions 4:2569
 - basic concepts 4:2568
 - coating development 4:2570^f
 - coating structure 4:2568^f, 4:2569^f
 - reactivity 4:2568, 4:2569^f, 4:2570^f

- glass-lined steel equipment manufacturing processes
 certifications and standards 3:2322, 3:2322*t*, 3:2323*t*
 glass formulations 3:2319, 3:2321*f*, 3:2321*t*
 glass preparation 3:2321
 lining process 3:2323
 metal preparation 3:2322
- high-temperature oxidation 1:466*f*, 1:468*f*
 historical background 3:1695
 hot dip aluminization 4:2572
 hot-salt corrosion 1:474*f*, 1:477*f*
 hydrogen cracking 2:923–927
 characteristics 1:95*t*
 general discussion 2:923
 hydrogen embrittlement
 basic concepts 2:925
 pipeline welds 2:925*f*
 testing methods 2:926, 2:927*f*
 hydrogen-induced cracking (HIC)
 basic concepts 2:924
 magnesium alloys 3:2028
 pipeline corrosion management 4:3294, 4:3295*f*
 steel pipes 2:859, 2:859*f*, 2:925*f*
 steel plates 2:924*f*
 stress-oriented HIC 4:3295
 testing methods 2:926
 titanium/titanium alloys 3:2047
 hydrogen sources 2:923, 2:924*f*
 stress-oriented hydrogen-induced cracking (SOHIC)
 failure mechanisms 2:925
 general discussion 2:925
 morphology 2:926*f*
 testing methods 2:927
 testing methods
 hydrogen embrittlement 2:926, 2:927*f*
 hydrogen-induced cracking (HIC) 2:926
 stress-oriented hydrogen-induced cracking (SOHIC) 2:927
- hydrogen embrittlement 2:912, 2:912*f*, 2:913*t*
 hydrogen sulfide (H₂S) environments 2:855*f*
 impressed current anodes 4:2782
 internal corrosion risks 4:3217*f*, 4:3218*f*
 iron–carbon (Fe–C) alloys
 equilibrium microstructures 3:1697, 3:1698*f*
 mechanical properties 3:1699, 3:1699*t*
 nonequilibrium microstructures 3:1697, 3:1698*f*
 phase diagram 3:1695, 3:1696*f*
 physical properties 3:1699, 3:1699*t*
 laser gas nitriding (LGS) 4:2632
 laser surface alloying (LSA) 4:2631
 low-alloy steel 3:1693–1736
 above-water fastener selection 2:847*f*
 acetic acid–sodium chloride mixtures 4:3059*t*
 adhesive bond failure 3:2473, 3:2473*f*, 3:2475*f*, 3:2476*f*, 3:2477*f*
 alloying element influences 3:1724*f*
 ammonia damage 4:3220*t*
 ammonium nitrate 4:2883
 aqueous corrosion
 crevice corrosion 3:1711
 differential aeration cell corrosion 3:1710, 3:1710*f*
 erosion-corrosion 3:1712
 flow-assisted corrosion 3:1712
 galvanic corrosion 3:1711
 general corrosion 3:1710
 pitting corrosion 3:1711
 protective treatments 3:1713
 solubility products 3:1712*t*
 tuberculation corrosion 3:1710*f*
 atmospheric corrosion
 acid regeneration cycle 3:1718
 air-borne pollutants 3:1715, 3:1715*t*, 3:1716*f*
 alloying effects 3:1720*f*, 3:1722*f*, 3:1723, 3:1724*f*
 atmospheric corrosivity classifications 3:1725, 3:1726*t*, 3:1727*t*
 climatic variation 3:1720, 3:1721*t*
 corrosion kinetics 3:1720
 corrosion mechanisms 3:1718
 corrosion product composition 3:1719
 corrosion rates 3:1722, 3:1722*f*, 3:1723*t*
 electrochemical mechanisms 3:1719
 environmental influences 3:1714
 exposure conditions 3:1721
 next generation weathering steels 3:1725, 3:1725*t*
 particulate matter 3:1715*f*, 3:1717, 3:1718*t*
 relative humidity (RH) 3:1714, 3:1715*f*, 3:1715*t*
 sea salt 3:1718*t*
 urban/rural/marine atmospheres 2:848*f*
 weathering steels 3:1723, 3:1724
 wet/dry cycles 3:1719, 3:1720*f*, 3:1723, 3:1725*f*
 below-water fastener selection 2:849*f*
 brazed joints 3:2451
 carbon dioxide (CO₂) environments 2:855*f*
 cathodic protection criteria 4:2847*t*
 chlorine-related corrosion 1:479*f*
 corrosion fatigue 2:944
 corrosion processes
 aqueous corrosion 3:1710
 corrosion products 3:1709*t*
 environmentally-assisted cracking 3:1712
 general discussion 3:1709
 high-temperature oxidation 3:1713
 hydrogen embrittlement 3:1713
 microbially-induced corrosion (MIC) 3:1713
 corrosion rates 2:1114*f*, 4:2876, 4:2878*f*
 corrosion testing 2:1475, 2:1476*f*, 2:1477*f*
 electrochemical effects 2:1088
 electrochemistry
 anodic dissolution 3:1704
 aqueous corrosive environments 3:1708
 cathodic reactions 3:1707
 passivity 3:1705
 potential–pH (Pourbaix) diagram 3:1702, 3:1703*f*, 3:1706*f*
 thermodynamics 3:1702
 environmentally-assisted cracking 4:3217*f*, 4:3218*f*
 erosion resistance 2:985*f*
 galvanic corrosion 2:1011, 2:1013*f*
 high-temperature oxidation 1:466*f*
 historical background 3:1695
 hydrogen sulfide (H₂S) damage 4:3219*f*
 hydrogen sulfide (H₂S) environments 2:855*f*
 iron–carbon (Fe–C) alloys
 equilibrium microstructures 3:1697, 3:1698*f*
 mechanical properties 3:1699, 3:1699*t*
 nonequilibrium microstructures 3:1697, 3:1698*f*
 phase diagram 3:1695, 3:1696*f*
 physical properties 3:1699, 3:1699*t*
 marine corrosion
 alloying element influences 3:1702*f*, 3:1702*t*
 corrosion profile 2:1121*f*
 corrosion rates 2:1114*f*, 2:1120, 2:1121*t*
 design-based mitigation 4:3080*f*
 exposure rate–dissolved oxygen plot 2:1124*f*
 exposure rate–seawater depth plot 2:1124*f*
 hydrogen embrittlement 2:1123–1124
 mass loss 2:1122*f*
 pitting corrosion 2:1122–1123, 2:1122*f*, 2:1123*f*
 polarization curves 2:1114*f*, 2:1120*f*
 protective treatments 2:1143
 seawater velocity effects 2:1122*f*
 materials selection 4:3210, 4:3210*f*
 metal dusting 1:290, 1:290*f*, 1:291*f*
 microbially-induced corrosion (MIC) 2:1176, 2:1177*f*
 molybdenum additives 3:2159
 oxidation resistance 1:558–582
 aluminum alloying effects 1:566
 carbon alloying effects 1:565
 carbon monoxide/carbon dioxide (CO/CO₂) environments 1:578, 1:579*f*
 cerium alloying effects 1:569
 chemical environments 1:577
 chromium alloying effects 1:568, 1:568*f*
 combustion gas conditions 1:576
 commercial low-alloy steels 1:572, 1:573*f*
 copper alloying effects 1:569
 general alloying effects 1:562, 1:563*f*, 1:564*f*
 general discussion 1:558
 governing factors 1:559, 1:560*f*

- steel (*continued*)
- growth stresses 1:571, 1:571*f*
 - industrial environments 1:573
 - iron oxidation 1:560, 1:561*f*, 1:562*f*
 - manganese alloying effects 1:567
 - molybdenum alloying effects 1:569
 - nickel alloying effects 1:568
 - phosphorus alloying effects 1:568
 - silicon alloying effects 1:566
 - steam environments 1:573, 1:575*f*, 1:576*f*
 - stress effects 1:570
 - sulfur alloying effects 1:567
 - system-applied stresses 1:572
 - thermal stresses 1:572
 - passivation current density 4:2876*f*, 4:2877*f*
 - passive range 4:2877*f*
 - phosphoric acid (H₃PO₄) 4:2881
 - potentiodynamic curves 4:2876*f*
 - processing techniques
 - alloying element influences 3:1702*f*, 3:1702*t*
 - corrosion rates 3:1700, 3:1701*t*, 3:1702*t*
 - marine corrosion resistance 3:1702*t*
 - mechanical deformation 3:1700, 3:1701*f*
 - protective barrier inducement (PBI) 4:2898*f*, 4:2899*f*
 - reducing environments 1:468*f*
 - scale inhibitors/dispersants 4:2993*t*
 - S-N (stress-number of cycles to failure) curves 2:930*f*
 - soil corrosion 2:1152*f*, 2:1157, 2:1157*f*, 2:1158*f*
 - storage tanks
 - alkaline environments 4:2888
 - cellulose boilers 4:2888
 - liquid fertilizer storage tanks 4:2888
 - sulfuric acid (H₂SO₄) 4:2887
 - stress corrosion cracking (SCC) 2:867*t*, 2:871*f*, 4:3058*f*
 - sulfidation corrosion 1:241-242, 1:241*f*, 1:242*f*, 1:246*f*
 - sulfuric acid (H₂SO₄) environments 2:1236*f*, 2:1238*f*, 4:3058*f*
 - sweet corrosion 4:3291
 - underground corrosion
 - buried steel 3:1732
 - controlling factors 3:1731, 3:1732*t*
 - long-term burial 3:1733
 - pillings 3:1732
 - pipelines 3:1733
 - water corrosion
 - accelerated low water corrosion (ALWC) 3:1729
 - boiler waters 3:1731
 - deposits and scales 3:1728
 - dissolved gases 3:1726
 - dissolved solids 3:1727
 - fouling deposits 3:1728
 - heating and cooling systems 3:1730, 3:1731*t*
 - height-related corrosion 3:1730, 3:1731*f*
 - microbial effects 3:1728
 - natural waters 3:1728, 3:1729*t*
 - piped fresh water systems 3:1729, 3:1730*t*
 - process waters 3:1730
 - under-deposit corrosion 3:1728
 - unprotected structural steel 3:1729
 - water composition 3:1726
 - wear effects 1:393*f*
 - welding processes 3:2456, 3:2457*f*
 - maraging steels
 - applications 3:1800
 - compositions 3:1793, 3:1795*t*
 - corrosion rates
 - acid corrosion 3:1795
 - atmospheric corrosion 3:1795, 3:1797*f*
 - industrial environments 3:1795
 - natural environments 3:1795
 - seawater corrosion 3:1795, 3:1797*f*
 - fabrication processes 3:1794
 - mechanical properties 3:1794, 3:1796*t*
 - physical properties 3:1795*t*
 - stress corrosion cracking (SCC)
 - cracking resistance 3:1798, 3:1798*f*
 - crack propagation rates 3:1799*t*
 - critical stress intensity factor (K_{ISCC}) 3:1798, 3:1799*f*
 - high-temperature corrosion 3:1800, 3:1800*f*
 - mechanisms 3:1796
 - metallurgical variables 3:1799, 3:1799*t*
 - testing methods 3:1797
 - structural characteristics 3:1794
 - materials selection 4:3210, 4:3210*f*
 - mechanical properties 3:1699, 3:1699*t*
 - mild steel
 - acid gas corrosion 2:1270-1298
 - aqueous carbon dioxide (CO₂) corrosion 2:1273
 - aqueous hydrogen sulfide (H₂S) corrosion 2:1286
 - background information 2:1273
 - alloying element influences 3:1724*f*
 - aqueous carbon dioxide (CO₂) corrosion
 - carbon dioxide (CO₂) partial pressure effects 2:1281, 2:1282*f*, 2:1283*f*
 - carbonic acid (H₂CO₃) reduction reactions 2:1278
 - carbonic species concentrations 2:1275*f*
 - characteristics 2:1273
 - condensation effects 2:1285
 - corrosion inhibitors 2:1284
 - corrosion rate calculations 2:1280
 - crude oil effects 2:1285
 - electrochemical reactions 2:1277
 - equilibrium relations 2:1273, 2:1274*f*, 2:1275*f*
 - flow effects 2:1283, 2:1284*f*
 - glycol/methanol effects 2:1285
 - hydronium (H⁺) ion reduction reactions 2:1278
 - influencing factors 2:1281
 - iron carbonate (FeCO₃) 2:1275*f*, 2:1276*f*, 2:1290*f*
 - localized corrosion 2:1286
 - mixed hydrogen sulfide-carbon dioxide (H₂S-CO₂) saturated
 - aqueous solutions 2:1289, 2:1292
 - modeling approaches 2:1280, 2:1281*f*
 - nonideal solutions/gases 2:1286
 - organic acid effects 2:1285
 - oxidation reactions 2:1278
 - pH effects 2:1274*f*, 2:1281, 2:1282*f*
 - solubility calculations 2:1287*f*
 - temperature effects 2:1282, 2:1283*f*
 - transport processes 2:1279
 - water (H₂O) reduction reactions 2:1279
 - aqueous hydrogen sulfide (H₂S) corrosion
 - characteristics 2:1286
 - corrosion rate calculations 2:1291, 2:1294*f*, 2:1296*f*
 - corrosion rate predictions 2:1297*f*
 - equilibrium relations 2:1287
 - flow effects 2:1295, 2:1295*f*
 - hydrogen sulfide (H₂S) partial pressure effects 2:1293, 2:1293*f*, 2:1294*f*
 - influencing factors 2:1293
 - iron sulfide (FeS) surface layer 2:1289*f*, 2:1290*f*
 - localized corrosion 2:1297
 - mixed hydrogen sulfide-carbon dioxide (H₂S-CO₂) saturated
 - aqueous solutions 2:1289, 2:1292
 - modeling limitations 2:1292
 - pH effects 2:1287*f*
 - pure hydrogen sulfide (H₂S) aqueous environment 2:1291
 - solubility calculations 2:1287*f*, 2:1289*f*
 - solubility product constants 2:1288*t*
 - sulfide species calculations 2:1287*f*
 - time effects 2:1294*f*, 2:1295, 2:1296*f*
 - cathodic protection criteria 4:2847*t*
 - corrosion rates 3:1702*t*
 - millscale formation 4:2487
 - phosphate coatings 4:2494
 - stress corrosion cracking (SCC) 2:867*t*
 - pH factors 2:1104
 - phosphate coatings 4:2494, 4:2500*t*
 - physical properties 3:1699, 3:1699*t*
 - processing techniques
 - alloying element influences 3:1702*f*, 3:1702*t*
 - corrosion rates 3:1700, 3:1701*t*, 3:1702*t*
 - heat treatments 3:1699
 - marine corrosion resistance 3:1702*t*
 - mechanical deformation 3:1700, 3:1701*f*
 - reducing environments 1:465
 - rust formation 4:2667

- sacrificial anodes 4:2774, 4:2774*t*, 4:2775*t*, 4:2780
S-N (stress–number of cycles to failure) curves 2:930*f*
soil corrosion 2:1157, 2:1157*f*, 2:1158*f*, 2:1159*f*
standard reduction potential 3:2074*t*
steel vessel fabrication 3:2344
Stellite 6
 cobalt-based alloys 3:1917
 coefficient of friction 1:380*f*
 corrosion behavior 3:1924, 3:1926*f*, 3:1927*f*
 erosion resistance 2:985*f*
 ‘glaze’ formation 1:379
 microstructure 3:1917*f*, 3:1918, 3:1919*f*, 3:1920
 Nimonic alloys–Stellite 6 wear-affected surfaces study
 aluminum oxide segregation 1:387*f*
 characteristics 1:366
 ‘glaze’ formation 1:382*f*, 1:384*f*
 Knoop hardness 1:357*f*
 relevant element oxidation tendencies 1:389*f*
 scanning electron microscopy (SEM) 1:381*f*, 1:383
 scanning transmission electron microscopy (STEM) 1:383
 sliding wear comparisons 1:388*f*
 spectral data 1:392*t*
 structural characteristics 1:387, 1:390*f*, 1:391*f*
 wear effects 1:385*f*, 1:386*f*
 wear maps 1:393, 1:394*f*
 normalized alloy content 3:1932, 3:1933*t*
 passive film analysis 3:1923, 3:1925*f*
 processing techniques 3:1920
 total weight loss (TWL) tests 3:1930, 3:1933*f*, 3:1934*f*
 wear–corrosion 3:1931, 3:1932*f*
 wear effects
 high-temperature wear behavior 1:357
 load–sliding speed effects 1:351
 SEM micrographs 1:358*f*, 1:359*f*, 1:361*f*, 1:363*f*, 1:364*f*, 1:368*f*, 1:369*f*
 wear rate variations 1:351*f*
 weight change comparisons 1:362*f*
 weight change comparisons 1:355*f*, 1:362*f*, 1:380*f*
 strength comparisons 3:2388*f*
 stress corrosion cracking (SCC) 2:867*t*, 2:1210–1211, 3:2458
 sulfate-reducing bacteria (SRB) 2:1174–1175, 2:1175*f*, 2:1176, 2:1177*f*
 sulfidation corrosion
 corrosion rate predictions 1:247*f*
 low-alloy steel 1:241–242, 1:242*f*
 sulfuric acid (H₂SO₄)
 corrosion rates 2:1228, 2:1228*f*
 storage tanks 2:1230*f*
 underground corrosion
 buried steel
 long-term burial 3:1733
 pilings 3:1732
 pipelines 3:1733
 controlling factors 3:1731, 3:1732*t*
 urban/rural/marine atmospheres 3:1751*t*
 vitreous enamel coatings 3:2331
 water corrosion
 deposits and scales
 fouling deposits 3:1728
 under-deposit corrosion 3:1728
 natural waters
 accelerated low water corrosion (ALWC) 3:1729
 corrosion rates 3:1728, 3:1729*t*
 height-related corrosion 3:1730, 3:1731*f*
 piped fresh water systems 3:1729, 3:1730*t*
 unprotected structural steel 3:1729
 process waters
 boiler waters 3:1731
 heating and cooling systems 3:1730, 3:1731*t*
 water composition
 dissolved gases 3:1726
 dissolved solids 3:1727
 general discussion 3:1726
 microbial effects 3:1728
 wear effects 1:351, 1:351*f*, 1:392*f*, 1:393*f*
 wood corrosivity
 contact corrosion 2:1324
 general discussion 2:1324
 preservative treatments 2:1327–1328
Stellite 6 steel
 cobalt-based alloys 3:1917
 coefficient of friction 1:380*f*
 corrosion behavior 3:1924, 3:1926*f*, 3:1927*f*
 erosion resistance 2:985*f*
 ‘glaze’ formation 1:379
 microstructure 3:1917*f*, 3:1918, 3:1919*f*, 3:1920
 Nimonic alloys–Stellite 6 wear-affected surfaces study
 characteristics 1:366
 Knoop hardness 1:357*f*
 relevant element oxidation tendencies 1:389*f*
 scanning electron microscopy (SEM) 1:381*f*, 1:383
 scanning transmission electron microscopy (STEM)
 aluminum oxide segregation 1:387*f*
 ‘glaze’ formation 1:382*f*, 1:383, 1:384*f*
 sliding wear comparisons 1:388*f*
 spectral data 1:392*t*
 wear effects 1:385*f*, 1:386*f*
 structural characteristics 1:387, 1:390*f*, 1:391*f*
 wear maps 1:393, 1:394*f*
 normalized alloy content 3:1932, 3:1933*t*
 passive film analysis 3:1923, 3:1925*f*
 processing techniques 3:1920
 total weight loss (TWL) tests 3:1930, 3:1933*f*, 3:1934*f*
 wear–corrosion 3:1931, 3:1932*f*
 wear effects
 high-temperature wear behavior 1:357
 load–sliding speed effects 1:351
 SEM micrographs 1:358*f*, 1:359*f*, 1:361*f*, 1:363*f*, 1:364*f*, 1:368*f*, 1:369*f*
 wear rate variations 1:351*f*
 weight change comparisons 1:362*f*
 weight change comparisons 1:355*f*, 1:362*f*, 1:380*f*
 step-wise cracking 2:924
 Stern–Geary relationship 2:1358, 4:3129
 stone 3:2000
 storage tanks 4:2705, 4:2706*f*
 straight line regression models
 basic concepts 2:1553
 coupon testing 2:1560, 2:1560*f*
 pit depth measurements 2:1571, 2:1572*f*
 wall thickness measurements 2:1567
 stray-current bonding systems 4:2807, 4:2807*f*
 stray-current corrosion 3:2062, 4:3280, 4:3280*f*
 Streicher test 2:1482
 stress corrosion cracking (SCC) 2:864–901
 aircraft corrosion
 airframe corrosion 4:3178, 4:3178*t*, 4:3179, 4:3180*t*
 aluminum alloys 4:3178*t*, 4:3180, 4:3182*t*
 high-strength steels 4:3182
 titanium alloys 4:3183
 aluminum alloys
 characteristics 3:1993
 intergranular corrosion 3:1994*f*
 marine environments 2:1138
 metal–environment combinations 2:867*t*
 resistance factors 3:1995*t*
 anodic models
 basic concepts 2:886
 crack velocity plot 2:890*f*
 current density 2:888*f*
 plastic strain distributions 2:889*f*
 potential–current decay 2:887*f*, 2:888*f*
 slip dissolution 2:887*f*, 2:889*f*, 2:890*f*
 ultrasharp cracks 2:890, 2:891*f*, 2:892*f*, 2:893*f*
 anodic protection 4:2864
 assessment parameters 4:3112, 4:3112*f*
 austenitic stainless steels 4:3061*f*
 boiling water reactors (BWRs)
 corrosion evolutionary path (CEP) 2:1672*f*
 crack depth modeling 2:1673*f*
 electrochemical corrosion potential (ECP) calculation 2:1670*f*, 2:1671*f*
 predicted damage plot 2:1672*f*
 predictive modeling 2:1669
 brass 2:867*t*, 3:1961
 brazed joints 3:2452
 cast iron corrosion 3:1770, 3:1772*f*
 characteristics 1:95*t*, 2:865, 2:866*f*

- stress corrosion cracking (SCC) (*continued*)
 copper/copper alloys 2:867*t*, 2:1135, 3:1957, 3:1957*f*, 3:1962
 corrosion-resistant alloys 2:1317
 crack chemistry 2:882
 cracking processes
 chlorine-induced corrosion 2:882, 2:883*f*, 2:884*f*
 crack coalescence 2:880, 2:880*f*, 2:881*f*
 crack morphology 2:882*f*, 2:883*f*
 electron backscatter diffraction (EBSD) 2:880–881, 2:882*f*
 dealloying mechanisms 2:807
 design-based mitigation 4:3069, 4:3070*f*, 4:3071*f*
 environmental conditions 2:885, 2:886*f*, 2:887*f*
 film-induced cleavage 2:892, 2:894*f*
 fracture mechanics 1:86, 1:87*f*, 1:88*f*
 heat exchangers and condensers 2:766
 hydrogen embrittlement 2:890, 2:893*f*
 intergranular stress corrosion cracking (IGSCC)
 anodic models 2:886
 characteristics 2:865, 2:866*f*
 electron backscatter diffraction (EBSD) 2:882*f*
 environmental conditions 2:885, 2:887*f*
 film-induced cleavage 2:892, 2:894*f*
 grain boundaries 2:873–874, 2:877*f*
 metallurgical factors 2:872
 modeling approaches 2:895–896, 2:897*f*
 predictive modeling 2:1669
 slip dissolution 2:890
 temperature dependence effects 2:897*f*
 yield strength 2:893*f*
 iron–nickel (Fe–Ni) alloys 3:1793, 3:1793*t*
 light water reactors (LWRs) 2:1333
 loading patterns 2:858*f*
 magnesium alloys 3:2030*t*, 3:2028
 maraging steels
 cracking resistance 3:1798, 3:1798*f*
 crack propagation rates 3:1799*t*
 critical stress intensity factor (K_{ISCC}) 3:1798, 3:1799*f*
 high-temperature corrosion 3:1800, 3:1800*f*
 mechanisms 3:1796
 metallurgical variables 3:1799, 3:1799*t*
 testing methods 3:1797
 mechanical fasteners 3:2449
 metal–environment combinations
 environment exposure 2:870
 loading mode 2:870
 loading severity 2:870
 mechanical considerations 2:866
 nuclear steam generators 2:866–867, 2:872*f*
 slow strain-rate tests 2:866, 2:871*f*
 specimen types 2:870
 testing methods 2:866–867
 typical combinations 2:867*t*
 metallurgical factors
 characteristics 2:870
 grain boundaries without precipitation 2:873, 2:877*f*
 grain boundary precipitation 2:875, 2:878*f*
 intragranular corrosion 2:877*f*
 potential dependence 2:872*f*
 solid solution composition
 caustic solutions 2:871, 2:874*f*
 Copson curve 2:873*f*
 dealloying 2:875*f*, 2:876*f*
 general discussion 2:871
 Graf curve 2:873*f*
 yield strength 2:876, 2:879*f*
 modeling approaches
 adsorption-induced dislocation emission (AIDE) 2:896, 2:898*f*
 surface mobility model 2:895, 2:896*f*
 temperature dependence effects 2:897*f*
 vacancy injection model 2:896, 2:897*f*
 nickel-based alloys 2:1136
 nitric acid (HNO₃) solutions 2:1258
 photographic illustration 4:3104*f*
 pipeline corrosion management
 characteristics 4:3299
 direct assessment techniques 4:3304
 external corrosion risks 4:3299
 high-pH stress corrosion cracking 4:3299
 near-neutral pH stress corrosion cracking 4:3300
 occurrence 4:3299
 risk assessment guidelines 4:3301
 process equipment risk management 4:3215*f*, 4:3217, 4:3220*f*, 4:3220*t*
 slip dissolution 2:887*f*, 2:889*f*, 2:890, 2:890*f*
 stainless steels
 alkaline solutions 2:1200, 3:1833
 atmospheric environments 3:1834, 3:1835*f*
 characteristics 3:1830, 3:1831*f*
 chlorine-induced mechanisms 3:1832, 3:1832*f*
 film-induced cleavage 3:1831
 highly corrosive environments 3:1822*f*
 hydrogen embrittlement 3:1831
 hydrogen-induced stress cracking (HISC) 2:859, 2:859*f*, 3:1833
 laboratory tests 3:1850
 marine environments 2:1125
 material selection tests 3:1849
 metal–environment combinations 2:867*t*
 nitric acid (HNO₃) solutions 2:1258
 performance predictions 4:3058*f*
 process mechanisms 3:1831
 slip dissolution 3:1831
 stress intensity factor–crack rate relationship 3:1832, 3:1832*f*
 sulfide stress cracking (SSC) 2:859, 2:859*f*, 2:860*f*, 3:1833
 steel 2:867*t*, 2:1210–1211, 3:2458
 strain-induced corrosion cracking (SICC) 2:861
 sulfide stress corrosion cracking (SSCC) 2:859, 2:859*f*, 2:860*f*, 4:3294
 sulfide stress cracking (SSC) 3:2458
 surface conditions 4:3110, 4:3111*f*
 titanium/titanium alloys 2:867*t*, 2:1138, 3:2047
 ultrasharp cracks 2:890, 2:891*f*, 2:892*f*, 2:893*f*
 uranium (U) 3:2186
 zirconium/zirconium alloys 2:867*t*, 3:2108
 stress-induced corrosion 4:3056
 stress-oriented hydrogen-induced cracking (SOHIC)
 failure mechanisms 2:925
 general discussion 2:925
 morphology 2:926*f*
 steels 2:1210–1211
 testing methods 2:927
 strontium (Sr)
 corrosion-resistant coatings 4:2995
 magnesium alloys 3:2015, 3:2016*t*
 seawater constituents 2:1109*t*
 strontium chromate (SrCrO₄) 2:993, 2:994*f*
 strontium oxide (SrO) 3:2321*t*
 structural adhesive joints 3:2463–2481
 adhesive bond failure 3:2463
 adhesively bonded substrate materials
 aluminum substrates 3:2475, 3:2477*f*, 3:2478*f*, 3:2479*f*
 aqueous solutions 3:2477*f*
 general discussion 3:2473
 low carbon steel substrates 3:2473, 3:2473*f*, 3:2475*f*, 3:2476*f*, 3:2477*f*
 seawater 3:2476*f*
 zinc substrates 3:2479
 bond durability improvements 3:2480
 failure mechanisms
 adhesive plasticization 3:2465, 3:2466*f*
 classifications
 cohesive failures 3:2466*f*, 3:2470*f*
 general discussion 3:2469
 interfacial failures 3:2466*f*, 3:2470*f*, 3:2471*f*, 3:2472*f*
 corrosion-induced failures
 anodic failures 3:2468
 cathodic delamination 3:2466, 3:2467*f*, 3:2468*f*
 hydrodynamic displacement 3:2464, 3:2464*f*, 3:2465*f*
 general discussion 3:2480
 structural metallurgy 1:52–76
 alloys
 complex alloy systems 1:75
 components and phases 1:62
 dislocation-based segregation 1:63
 equilibrium phase diagrams
 binary isomorphous phase diagrams 1:64, 1:64*f*
 complex binary phase diagrams 1:66, 1:67*f*, 1:68*f*, 1:69*f*, 1:70*f*
 coring 1:65

- eutectic phase diagrams 1:65, 1:65f, 1:66f
- general discussion 1:63
- general discussion 1:61
- grain boundary-based segregation 1:63
- intermediate phases/intermetallic compounds 1:63
- iron–iron carbide (Fe–Fe₃C) phase diagram
 - austenite decomposition 1:66
 - bainite formation 1:70, 1:71f
 - general discussion 1:66
 - hypo-eutectoid steel transformation 1:71, 1:72f
 - iron-rich end 1:69f
 - isothermal transformation diagrams 1:71, 1:71f, 1:72f
 - martensite formation 1:70, 1:71f
 - martensite tempering 1:72, 1:73f
 - pearlite formation 1:69, 1:70f, 1:71f
 - spheroidized structures 1:73
- limited and complete solid solubility 1:63
- solid solutions 1:62, 1:62f
- equilibrium phase diagrams
 - binary isomorphous phase diagrams 1:64, 1:64f
 - complex binary phase diagrams 1:66, 1:67f, 1:68f, 1:69f, 1:70f
 - coring 1:65
 - eutectic phase diagrams 1:65, 1:65f, 1:66f
 - general discussion 1:63
- general discussion 1:52
- iron–iron carbide (Fe–Fe₃C) phase diagram
 - austenite decomposition 1:66
 - bainite formation 1:70, 1:71f
 - general discussion 1:66
 - hypo-eutectoid steel transformation 1:71, 1:72f
 - iron-rich end 1:69f
 - isothermal transformation diagrams 1:71, 1:71f, 1:72f
 - martensite formation 1:70, 1:71f
 - martensite tempering 1:72, 1:73f
 - pearlite formation 1:69, 1:70f, 1:71f
 - spheroidized structures 1:73
- pure metals
 - annealing processes 1:60
 - characteristics 1:52, 1:55t
 - close-packed structure 1:55f
 - dislocations 1:57, 1:58f, 1:59f
 - grains and grain boundaries 1:58, 1:59f, 1:60f, 1:61f
 - line defects 1:56, 1:57f
 - macroscopic defects 1:60
 - point defects 1:54, 1:56f
 - polycrystalline metals 1:58
 - stacking faults and twins 1:55, 1:56f
 - surface structure/surface defects 1:60, 1:61f
 - unit cells 1:54f
- strengthening mechanisms
 - complex alloy systems 1:75
 - general discussion 1:73
 - inclusions 1:59f, 1:76
 - precipitation hardening 1:74, 1:74f, 1:75f
- Student's *t* distribution 2:1556
- styrene 3:1908, 3:2371, 4:2995t
- styrene butadiene rubber (SBR)
 - applications 3:2412t
 - chemical structure 3:2415f
 - glass-transition temperature (*T_g*) 3:2416t
 - heat/oil resistance class 3:2413f
 - oxidation and ozone resistance 3:2416t
 - production mechanisms 3:2410–2411
 - solubility parameters 3:2379t
 - swelling resistance 3:2416t
- submerged entry nozzle (SEN) 1:682, 1:682f
- submerged structures 2:768
- sulfate-induced corrosion
 - cement
 - acid corrosion 2:1180
 - conventional sulfate attacks 3:2363, 3:2363f
 - delayed ettringite formation 3:2365
 - thaumasite form of sulfate attack (TSA) 3:2364
- sulfonated styrene (SS) 4:2966
- sulfonic acid 4:2966
- sulfur (S)
 - alloying effects 1:567
 - alumina-forming alloys 1:608t, 1:609t, 1:630, 1:638
 - aluminum sulfate (Al₂SO₄) 2:1086–1087, 3:1769t
 - ammonium bisulfide (NH₄HS) 4:3221–3223
 - anodic protection
 - sulfate compounds 4:2883
 - sulfuric acid (H₂SO₄) 4:2874t, 4:2876
 - atmospheric gases 2:1054, 2:1054t
 - calcium sulfate (CaSO₄) 1:477f, 2:1102, 4:2938–2939, 4:2942t
 - carbon disulfide (CS₂) 2:1054, 2:1054t, 3:2380t
 - carbonyl sulfide (COS)
 - atmospheric gases 2:1054, 2:1054t
 - combustion conditions 1:461f
 - flue gas composition 1:462t
 - sulfidation corrosion
 - corrosion mechanisms 1:240
 - laboratory simulations 1:245, 1:254f, 1:254t, 1:255f
 - parabolic rate constant plot 1:256f
 - sulfidation/oxidation mechanisms 1:249, 1:250f, 1:255f, 1:256f, 1:259f, 1:260f
 - thermochemical models 1:254f, 1:254t, 1:255f
 - cast iron corrosion 3:1774, 3:1774t
 - chromia-forming alloys 1:608t, 1:609t
 - chromium sulfate (CrSO₄) 1:477f
 - chromium–sulfur (Cr–S) alloys 1:589
 - cobalt sulfate (CoSO₄) 1:477f
 - concrete degradation
 - conventional sulfate attacks 3:2363, 3:2363f
 - delayed ettringite formation 3:2365
 - thaumasite form of sulfate attack (TSA) 3:2364
 - copper sulfate (CuSO₄)
 - corrosion test methods 2:1479t, 2:1480f, 2:1481, 2:1482f
 - reference electrodes
 - cathodic protection 4:2754, 4:2754t, 4:2850f
 - common reference electrodes 2:1371t
 - design guidelines 1:46, 1:47f, 1:48t
 - potential measurements 4:2848, 4:2849t
 - corrosive environments
 - alumina-forming alloys 1:638
 - coal-fired boiler corrosion 1:404
 - general discussion 1:403
 - oil-fired boiler corrosion 1:404
 - crosslink concentration effects on latex 3:2428, 3:2430f, 3:2430t
 - dibenzyl sulfide 4:2991
 - dibenzyl sulfoxide 4:2991
 - diffusion coatings 4:2548t
 - dimethyl sulfide (DMS) 2:1054, 2:1054t, 2:1067f
 - fuel chemistry 1:459, 1:459t, 1:460f, 1:461f
 - gypsum (CaSO₄·2H₂O) 4:2938, 4:2942t
 - hemihydrate (CaSO₄·1/2H₂O) 4:2942t
 - high-temperature stainless steels 3:1876
 - hydrogen sulfide (H₂S)
 - aqueous corrosive environments 2:1286
 - atmospheric gases 2:1054, 2:1054t
 - cast iron corrosion 3:1783, 3:1784t
 - corrosive environments 2:855f
 - dry deposition rates 2:1073t
 - environmental conditions 2:1082t
 - flue gas composition 1:462t
 - gaseous environments 3:1783, 3:1784t, 3:2164
 - mild steel corrosion 2:1286
 - polluted environments 3:1963, 3:1964t, 3:1965f
 - process equipment risk management 4:3217f, 4:3219f
 - sour corrosion
 - general discussion 4:3294
 - hydrogen-induced cracking (HIC) 4:3294, 4:3295f
 - sulfide stress corrosion cracking (SSCC) 4:3294
 - stainless steel corrosion 3:1867
 - sulfate-reducing bacteria (SRB) 2:1156, 2:1174, 2:1177f
 - sulfidation corrosion
 - corrosion mechanisms 1:240, 1:253f
 - corrosion rate predictions 1:243, 1:246f, 1:247f, 1:259f
 - laboratory simulations 1:245, 1:254f, 1:254t, 1:255f
 - parabolic rate constant plot 1:256f
 - pressure effects 1:241f, 1:259f, 1:260f
 - steam concentration effects 1:260f
 - sulfidation/oxidation mechanisms 1:249, 1:250f, 1:255f, 1:256f, 1:259f, 1:260f

- sulfur (S) (*continued*)
 temperature effects 1:242f
 thermochemical models 1:254f, 1:254t, 1:255f
 sulfide stress cracking (SSC) 2:859, 2:859f, 2:860f, 3:1833, 4:3294
 sweet corrosion 4:3293
 water chemistry 2:1096, 4:2937–2938, 4:2939f
- intermetallic alloys
 hot corrosion
 gaseous environments 1:660
 molten salts 1:661, 1:661f
 impurities 1:230, 1:231f, 1:654–655
- iron–nickel–sulfur (Fe–Ni–S) alloys 1:244f, 1:245f
- iron sulfate (FeSO₄) 1:320f
- iron sulfide (FeS)
 aqueous hydrogen sulfide (H₂S) corrosion 2:1288, 2:1289f, 2:1290f
 compositions 4:2938, 4:2942f
 flow-induced corrosion 2:965f
 sulfate-reducing bacteria (SRB) 2:1174, 2:1177f
- iron sulfide (FeS₂) 1:320f, 2:1288
- lead sulfate (PbSO₄) 3:2057–2058, 3:2058f, 3:2060t, 4:2670
- lead sulfide (PbS) 3:2060t
- low-alloy steels 1:567
- lubricant systems 2:1303
- magnesium sulfate (MgSO₄) 1:477f, 4:2938–2939
- manganese sulfate (MnSO₄) 1:477f
- metal dusting protection 1:300, 1:301f
- mining industry 4:2994
- molybdenum sulfide (MoS₂) 3:2164
- nickel–sulfur (Ni–S) alloys 1:242, 1:243f, 1:245f
- pitting corrosion 2:774t
- polysulfones 3:2384
- potassium aluminum sulfate (KAl(SO₄)₂·12H₂O) 3:1769t
- potassium sulfate (K₂SO₄) 1:477f, 1:531f
- potential–pH (Pourbaix) diagram 3:1706f
- rain chemistry 2:1063f, 2:1064t
- sodium–iron–sulfur–oxygen (Na–Fe–S–O) phase diagram 1:320f
- sodium sulfate (Na₂SO₄)
 hot-salt corrosion 1:325, 1:326f, 1:675
 metal–matrix composites 3:2265, 3:2265f
 oxide solubility 1:320–321, 1:320f, 1:531f
 phase diagram 1:531f
 water chemistry 4:2938–2939
- sodium sulfide (Na₂S) 1:320f
- sodium sulfite (Na₂SO₃) 4:2975–2976, 4:2976t
- stainless steel corrosion 3:1868
- stainless steels 3:1811, 3:1876
- sulfane acid 4:2882
- sulfate-induced corrosion
 cement 3:2363
 coal constituents 1:475f
 combustion conditions 1:461f
 corrosion rates 1:473f
 fireside corrosion 1:461f, 1:472, 1:473f, 1:474f, 1:477f, 1:478f
 flue gas composition 1:462t
 oxide basicity 1:477f
 oxide solubility 1:476f
 superheater deposit composition 1:464t
 water aggressiveness and corrosiveness 3:1754t
- sulfate melts
 background information 1:316
 gas solubility 1:317
 oxide solubility 1:320, 1:320f, 1:321f
 Rapp–Goto corrosion criterion 1:322, 1:322f, 1:323f
 redox reactions
 basic concepts 1:317
 chronopotentiometric curve 1:319f
 limiting diffusion current density 1:318f
 thermodynamics 1:317
- sulfate-reducing bacteria (SRB)
 acid corrosion
 concrete degradation 2:1180
 fungi 2:1181
 sulfuric acid (H₂SO₄) 2:1179, 2:1180f, 2:1181f
- black water corrosion 2:1175f, 2:1176
- cast iron 3:1775
- copper/copper alloys 2:1178, 2:1178f
Desulfovibrio spp. 2:1174, 2:1174f
- environmental conditions 2:1174, 2:1175f, 2:1176f
Gallionella spp. 2:1177, 2:1178f, 2:1183, 4:2920
- industrial heating and cooling systems 4:2949
- iron corrosion 2:1176, 2:1177f
- lead (Pb) 3:2063
- low-alloy steel 2:1176, 2:1177f
- marine environments 2:1114–1115, 2:1132–1133
- oil and gas industry 4:2920
- pipeline corrosion management 4:3279, 4:3295
- seawater constituents 2:1109, 2:1109t
- soil corrosion 2:1156, 2:1161
- stainless steels 2:1176, 2:1177f, 2:1178f
- sulfidation
 alloys
 alloy compositions 1:246t
 corrosion mechanisms 1:240, 1:241f, 1:267
 corrosion rate predictions 1:243, 1:246f, 1:247f, 1:259f
 environment-based alloy selection 1:551–552, 1:552f
 equipment concerns 1:240
 high-nickel alloys 1:242, 1:243f, 1:245f
 hydrogen sulfide (H₂S) 1:240, 1:241f, 1:242f
 iron–nickel–sulfur (Fe–Ni–S) alloys 1:244f, 1:245f
 laboratory simulations 1:245
 nickel–sulfur (Ni–S) alloys 1:242, 1:243f
 parabolic rate constant plot 1:256f
 pressure effects 1:259f, 1:260f
 steam concentration effects 1:260f
 sulfidation/oxidation mechanisms 1:249, 1:250f, 1:255f, 1:256f, 1:259f, 1:260f
 time dependence factors 1:243, 1:248f
- sulfide stress corrosion cracking (SSCC) 2:859, 2:859f, 2:860f, 3:2458, 4:3294
- sulfur dioxide (SO₂)
 atmospheric gases 2:1053t, 2:1054, 2:1054t
 cast iron corrosion 3:1783
 combustion conditions 1:461f
 corrosion test methods 2:1474
 dry deposition rates 2:1073t
 environmental conditions 2:1082t
 flue gas composition 1:460t, 1:462t, 1:463t
 gaseous environments 3:1783, 3:2164
 Henry's law coefficients for common gases 2:1056, 2:1056t
 high-temperature corrosion 1:182t, 1:183f, 3:2164
 iron aluminides (FeAl/Fe₃Al) 1:660
 oxidation reactions 2:1056
 steel corrosion 3:1715, 3:1716f
 transport mechanisms 2:1067f
 wood degradation effects 3:2443–2444
- sulfuric acid (H₂SO₄) 2:1226–1249
 acid pickling 4:2990, 4:2992t
 alumina ceramics 3:2290, 3:2291t, 3:2292f, 3:2302f
 aluminum/aluminum alloys 2:1242, 3:1999f
 aluminum coatings 4:2564f
 ammonia–nitric acid–sulfuric acid–water (NH₃–HNO₃–H₂SO₄–H₂O) systems 2:1058
 anodic protection 4:2874t
- carbon steel
 corrosion rates 3:1792, 3:1792t, 4:2876, 4:2878f
 passivation current density 4:2876f, 4:2877f
 passive range 4:2877f
 potentiodynamic curves 4:2876f
 storage tanks 4:2887
- cast iron
 anodic polarization curves 2:1229f
 anodic protection 4:2876
 corrosion rates 2:1228, 2:1228f, 3:1743f, 3:1761f, 3:1763, 3:1764f
 high chromium cast iron 3:1764f
 iso-corrosion curve plot 3:1762f, 3:1764f
 silicon-based cast iron 3:1764f
 characteristics 2:1226
 concrete degradation 2:1180
 copper/copper alloys 2:1243, 3:1963
 corrosion test methods 2:1479t, 2:1480f, 2:1481, 2:1482, 2:1482f
 glass linings and coatings 3:2324t
 inhibitors 4:2990
 lead corrosivity 3:2063
 lead/lead alloys 2:1244, 2:1245f

- lead sulfate (PbSO₄) 3:2057–2058, 3:2058f
- maraging steels 3:1795
- marine aerosols 2:1059, 2:1061
- materials selection 4:3058f
- nickel alloys
- anodic polarization curves 2:1239f
 - chloride contamination 2:1241f
 - corrosion rates 2:1238, 2:1239f
 - corrosion test methods 2:1479t, 2:1480f, 2:1481, 2:1482f
 - iron alloying influences 2:1240f
 - iron–nickel (Fe–Ni) alloys 3:1792, 3:1792t
 - nickel–chromium–iron–molybdenum–copper (Ni–Cr–Fe–Mo–Cu) alloys 3:1893f, 3:1894t, 3:1897f
 - nickel–chromium–molybdenum (Ni–Cr–Mo) alloys 3:1887f, 3:1888f
 - organic solvents 1:98f
 - oxidizing environments 2:1240f
 - performance characteristics 2:1241, 2:1242f, 2:1242t, 2:1243f
 - protection mechanisms 2:1238, 2:1239f
 - sulfuric acid (H₂SO₄) isocorrosion diagram 2:1242f, 2:1243f
 - velocity factors 2:1241f
- niobium corrosion 3:2144, 3:2145f
- noble metal corrosion resistance 3:2216t, 3:2246
- nonmetallic materials
- general discussion 2:1246
 - inorganic materials 2:1248
 - organic materials 2:1246
- process equipment risk management 4:3217f
- production and handling 3:1903, 3:1904f, 3:1905f
- scale inhibitors/dispersants 4:2994
- solution structure 2:1227f
- specific conductivity 4:2876
- stainless steels
- anodic polarization curves 2:1231f, 2:1236f
 - austenitic stainless steels 2:1232f, 2:1235, 2:1237f
 - chromium alloying influences 2:1232–1233, 2:1233f
 - compositions 2:1231t
 - contaminant effects 2:1235f
 - copper alloying influences 2:1232–1233, 2:1233f
 - corrosion rates 3:1838, 3:1839f, 3:1840f, 4:2878, 4:2879f
 - ferritic chromium steels 2:1231f
 - molybdenum alloying influences 2:1232–1233, 2:1233f
 - nickel alloying influences 2:1232–1233, 2:1233f
 - oxidizing environments 2:1233–1234, 2:1234f
 - passivation current density 4:2879f
 - passive films 2:1234
 - passive range 4:2879f
 - performance characteristics 2:1235, 2:1236f, 2:1237f, 2:1238f
 - polarization curves 2:1354, 2:1355f
 - protection mechanisms 2:1230
 - silicon alloying influences 2:1232–1233
 - stainless steel vessels 4:2886, 4:2887, 4:2887f, 4:2888f
 - temperature effects 2:1236f
 - velocity factors 2:1234, 2:1236f
- steel
- corrosion rates 2:1228, 2:1228f
 - storage tanks 2:1230f
- sulfuric acid–ammonia–water (H₂SO₄–NH₃–H₂O) systems 2:1057, 2:1058f
- sulfuric acid–iron sulfate (H₂SO₄–FeSO₄) test (Streicher test) 2:1479t, 2:1480f, 2:1480t, 2:1482
- sulfur-oxidizing bacteria 2:1179, 2:1180f, 2:1181f
- tantalum/tantalum alloys 2:1246, 2:1246f, 2:1247f, 3:2144, 3:2145f
- tin passivation 3:2071
- titanium/titanium alloys
- corrosion rates 4:2880, 4:2881f
 - corrosion resistance 2:1243
 - isocorrosion rate curves 2:1244f
 - passivation current density 4:2881f
- water treatment 2:1103
- zirconium corrosivity
- anodic polarization curves 2:1245f, 3:2117f
 - characteristics 3:2113
 - chloride ion effects 3:2118f
 - corrosion rates 3:2118f, 3:2124t
 - corrosion resistance 2:1244
 - isocorrosion diagram 3:2115f, 3:2116f, 3:2117f
 - sulfuric acid-using processes 3:2130
- vulcanization processes
- basic concepts 3:2417
 - conjugated diene and triene groups 3:2436
 - cyclic sulfides 3:2436
 - disulfidic crosslink 3:2436
 - extra-network material 3:2436
 - monosulfidic crosslink 3:2436
 - pendent accelerator groups 3:2436
 - polysulfidic crosslink 3:2436
 - system characteristics 3:2418t
 - water chemistry 2:1098, 2:1098t, 4:2937–2938, 4:2939t
- superalloys 1:692, 1:693f, 1:693t, 3:1918
- supersonic RF plasma spraying 4:2615
- superstructures 4:2699, 4:2699t
- surface films
- ionizing radiation effects 2:1331
 - wear theory 1:341
- surface pretreatments 4:2483
- chemical cleaning
- acidic cleaners 4:2485
 - acid pickling
 - alloy steels 4:2489
 - general discussion 4:2487
 - hydrogen embrittlement 4:2489
 - millscale formation 4:2487
 - nonferrous metals 4:2491, 4:2491t
 - pickling inhibitors 4:2489, 4:2490f
 - scale removal mechanisms 4:2488, 4:2488f, 4:2991, 4:2993t
 - alkaline cleaners 4:2486, 4:2486t, 4:2487f, 4:2487t
 - background information 4:2484
 - electrochemical cleaning 4:2491
 - neutral cleaners 4:2485
 - solvent cleaning
 - emulsifiable cleaners 4:2485
 - emulsion cleaners 4:2485
 - general discussion 4:2484
 - vapor degreasing 4:2484
 - surfactants 4:2486–2487, 4:2487f, 4:2487t
 - ultrasonic cleaning 4:2491
 - general discussion 4:2484
- mechanical cleaning
- abrasive blasting
 - general discussion 4:2492
 - surface finish 4:2492
 - surface profile 4:2492
 - flame cleaning 4:2491
 - health and safety concerns 4:2492
 - manual cleaning 4:2491
 - ultrahigh pressure water jetting 4:2492
- standards 4:2493
- surfacers 4:3173
- surfactants
- alkaline cleaners 4:2486–2487, 4:2487f, 4:2487t
 - oil and gas industry 4:2904
 - organic coatings 4:2653
 - water treatment 2:1104
- surgical implants
- corrosion-resistant alloys
 - cobalt–chromium–molybdenum (CoCrMo) alloy 2:764, 2:1310, 2:1314, 2:1317, 3:1927
 - corrosion types
 - corrosion fatigue 2:1318, 3:2049
 - crevice corrosion 2:1317
 - fretting corrosion 2:1318
 - galvanic corrosion 2:1319
 - general corrosion 2:1316
 - general discussion 2:1319
 - hydrogen embrittlement 2:1317
 - pitting corrosion 2:1317
 - stress corrosion cracking (SCC) 2:1317
- dental amalgams 2:1316
- magnesium alloys 2:1315
- metallic foams 2:1315
- nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
- porous materials 2:1315
- rare earth magnets 2:1310, 2:1316
- stainless steels 2:764, 2:1314

- surgical implants (*continued*)
 surface finish 2:1313
 titanium nitride (TiN) coatings 2:1316
 titanium/titanium alloys 2:764, 2:1310, 2:1313, 2:1317, 3:2164
 crevice corrosion 2:763
 environmental conditions 2:1311, 2:1312*f*
 evaluation methods 2:761
 health effects 2:1310, 2:1310*r*
 historical background 2:1308
 niobium (Nb) 3:2148
 tantalum (Ta) 3:2148
 titanium/titanium alloys 3:2049
 sweet chestnut 2:1325*r*
 sweet corrosion
 basic concepts 4:3291
 flow rate effects 4:3292
 hydrogen sulfide (H₂S) content effects 4:3293
 partial pressure effects 4:3292
 pH effects 4:3292
 temperature effects 4:3292
 Swiss cheese hazard management model 4:3239–3240, 4:3035–3036, 4:3035*f*
 synchrotron radiation 2:1388, 2:1388*f*
 synthesis gas reaction 1:274
 synthetic elastomers 3:2407–2438
 classifications
 by ISO designations
 brittleness temperature limits 3:2413*r*
 general discussion 3:2411
 heat aging temperature 3:2412*r*
 heat/oil resistance class 3:2413*f*
 volume swelling limits 3:2412*r*
 by origin 3:2410
 by purpose 3:2411, 3:2412*r*
 flex cracking 3:2426
 future developments 3:2437
 heat aging resistance 3:2426, 3:2426*f*
 oil absorption effects
 automotive rubber components 3:2427*f*
 crosslink concentration effects 3:2428, 3:2430*f*, 3:2430*r*
 general discussion 3:2427
 mass uptake 3:2430*f*, 3:2430*r*
 penetration rate–viscosity relationship 3:2428*f*, 3:2429*f*
 swelling resistance 3:2428
 ozone degradation 3:2424, 3:2425*f*
 processing techniques
 mastication and mixing 3:2416
 rubber compounding 3:2416
 schematic flow chart 3:2417*f*
 vulcanization 3:2417, 3:2418*r*
 properties
 general discussion 3:2409, 3:2413
 mechanical properties 3:2409
 structure–property relationship
 chemical structure 3:2414*r*, 3:2415*f*
 glass-transition temperature (T_g) 3:2416, 3:2416*r*
 mechanical strength 3:2413
 oxidation and ozone resistance 3:2415, 3:2416*r*
 swelling resistance 3:2415, 3:2416*r*
 protective measures
 aging effects 3:2431
 antidegradants
 antiozonant mechanisms 3:2433, 3:2434*f*, 3:2435*f*
 basic concepts 3:2432, 3:2432*f*
 layer formation theories 3:2433, 3:2434*f*, 3:2435*f*
 elastomer blends 3:2431
 elastomer selection 3:2431
 paraffin wax blooming 3:2435
 sulfur vulcanization
 conjugated diene and triene groups 3:2436
 cyclic sulfides 3:2436
 disulfidic crosslink 3:2436
 extra-network material 3:2436
 monosulfidic crosslink 3:2436
 pendent accelerator groups 3:2436
 polysulfidic crosslink 3:2436
 vulcanization system
 general discussion 3:2435
 metallic oxide vulcanization 3:2437
 peroxide vulcanization 3:2436
 quinonedioximes vulcanization 3:2437
 resin vulcanization 3:2437
 sulfur vulcanization 3:2436
 urethane crosslinking system 3:2437
 rubber-to-metal bonding
 bond failure 3:2421, 3:2473, 3:2473*f*
 bonding process
 bonding agents 3:2420
 metal plate preparation 3:2420
 molding methods 3:2420
 engineering and automotive applications 3:2418, 3:2419*f*
 vulcanization
 general discussion 3:2421
 hot air/ambient temperature technique 3:2421
 steam pressure technique 3:2421
 water curing technique 3:2421
 vulcanization processes
 basic concepts 3:2417
 general discussion 3:2435
 metallic oxide vulcanization 3:2437
 peroxide vulcanization 3:2436
 quinonedioximes vulcanization 3:2437
 resin vulcanization 3:2437
 rubber-to-metal bonding
 hot air/ambient temperature technique 3:2421
 steam pressure technique 3:2421
 system characteristics 3:2418*r*
 water curing technique 3:2421
 sulfur vulcanization
 basic concepts 3:2417
 polysulfidic crosslink 3:2436
 system characteristics 3:2418*r*
 urethane crosslinking system 3:2437
 water absorption effects 3:2429, 3:2430*f*, 3:2431*f*
 synthetic polyisoprene rubber (IR) 3:2412*r*, 3:2415*f*
- T**
- tackiness 4:2743
 Tafel's law
 electrochemical kinetics–corrosion potential 1:43, 1:44*f*, 1:45*f*, 2:726, 2:726*f*
 iron oxidation reactions 2:1278
 linear polarization resistance measurements (LPRMs) 2:1358
 pit propagation rate 2:1659
 polarization curves 2:1355, 2:1356*f*
 polarization resistance calculations 2:1469, 2:1469*f*
 potentiodynamic curves 2:1209*f*
 uniform corrosion 2:726
 talcum 4:2995
 tannins 2:1324, 3:2444, 4:2996–2997, 4:3334, 4:3335*f*
 tantalum (Ta) 3:2135–2150
 alloys
 alumina-forming alloys 1:608*r*, 1:609*r*
 amorphous alloys 3:2193–2194
 anhydrous hydrogen halide gases/hydrohalic acids 2:1216*f*, 2:1222, 2:1223*f*
 chromia-forming alloys 1:608*r*, 1:609*r*
 chromium–tantalum (Cr–Ta) alloys 3:2198–2199, 3:2198*f*, 3:2199*f*
 cobalt-based alloys 3:1918, 3:1918*r*
 intermetallic alloys 1:656
 mechanical properties 3:2137*r*, 3:2137
 nickel-based superalloys 1:693*r*
 process equipment materials 4:3211
 sulfuric acid (H₂SO₄) environments 2:1246, 2:1246*f*, 2:1247*f*
 Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 applications 3:2138*r*, 3:2138
 corrosion resistance 2:1337
 corrosivity
 anodic oxide films 3:2141, 3:2141*r*
 aqueous corrosive environments
 alkali corrosion 3:2146*r*, 3:2145
 aqueous salts 3:2147
 fluorine (F) 3:2144, 3:2146

- galvanic corrosion 3:2146, 3:2147*t*
hydrochloric acid (HCl) 3:2145*f*
hydrogen embrittlement 3:2146
mineral acids 3:2144
sulfuric acid (H₂SO₄) 3:2145*f*
corrosion behavior 3:2142
gaseous environments
 halide-containing environments 3:2144
 hydride formation 3:2144
 nitridation 3:2144
 oxidation 3:2143
liquid metals 3:2147
organic compounds 3:2148
passive films 3:2142
sulfuric acid (H₂SO₄) environments 4:3058*f*
diffusion coatings 4:2535*t*
economic considerations 3:2138
electrochemistry
 electrochemical potential 3:2147*t*
 hydride formation 3:2139, 3:2144
 potential–pH (Pourbaix) diagram 3:2140*f*
 thermodynamics 3:2139
fabrication processes 3:2137
fluoride corrosion 2:1264
historical background 3:2135
industrial applications
 anodes 3:2148
 chemical process equipment 3:2148
 medical/*in vivo* applications 3:2148
mechanical properties 3:2137*t*, 3:2137*t*, 3:2136
nitric acid (HNO₃)
 containment materials 2:1255
 corrosion rates 2:1253*t*
 occurrence 3:2136
 oxidation processes 1:203, 1:204*f*
 physical properties 3:2136, 3:2136*t*
 platinized tantalum anodes 4:2795, 4:2795*t*, 4:2813
 production processes 3:2136
 tantalum beryllide (TaBe₂) 3:2177
 tantalum nitride (TaN) 1:308*f*
 tantalum oxide (Ta₂O₅) 1:146*t*, 1:203, 1:204*f*, 1:542*f*, 3:2197*f*
tape wrap systems 4:3283, 4:3283*t*
tar acids 3:1766
tartaric acid 3:2073
teak 2:1325*t*
tellurium–lead (Te–Pb) alloys 3:2055, 3:2055*t*
temporary protective coatings 4:2678–2682
 application methods 4:2679*t*, 4:2681
 characteristics
 hard-film materials 4:2679, 4:2679*t*
 oil-type materials 4:2679*t*, 4:2680
 soft-film materials 4:2678, 4:2679*t*
 strippable coatings 4:2679*t*, 4:2680
 volatile corrosion inhibitors 4:2679*t*, 4:2680
 water displacing agents 4:2679*t*, 4:2680
 failure mechanisms 4:2681
 functionality 4:2681
 general discussion 4:2678
 suitability 4:2680
TEM tomography 2:1416
 see also transmission electron microscopy (TEM)
Teredo spp. 3:2442, 3:2445–2445
termites 3:2445
terne coatings 4:2565, 4:2571
terrace–ledge–kink (TLK) surfaces 1:107, 1:107*f*
tetracalcium aluminoferrite (C₄AF) 3:2350*t*, 3:2351
tetrachloromethane 3:2380*t*
tetragonal zirconia polycrystals (TZP) 3:2294, 3:2302*f*
thaumasite form of sulfate attack (TSA) 3:2364
thermal barrier coatings
 gas turbines
 characteristics 1:527*f*
 damage mechanisms 1:527
 operation principles 1:524*f*
 spallation models 1:528*f*, 1:529, 1:529*f*
 high-temperature coatings
 aeroengine applications 1:704*f*
 characteristics 1:704
 cross-section diagram 1:705*f*
 failure characteristics 1:713, 1:714*f*, 1:715*f*, 1:716*f*
 oxidation-induced failure 1:712
 schematic cross-section diagram 1:705*f*
 strain energy 1:715
 subcritical crack growth
 chemical failures 1:719, 1:720*f*
 martensite formation 1:717
 mechanical instabilities 1:716*f*, 1:717
 surface roughness 1:718, 1:719*f*, 1:720*f*, 1:721*f*
 transformation strains 1:716
 surface roughness 1:720, 1:721*f*
 time-to-failure data plot 1:713*f*
 topcoat cracking 1:716*f*, 1:721*f*
 intermetallic alloys 1:664–665
 laser cladding (LC) 4:2625
 sprayed coatings 4:2620
thermal spraying
 basic concepts 4:2611
 cold-gas dynamic spraying (CGDS) 4:2612*t*, 4:2616
 detonation gun spraying (D-Gun) 4:2612*t*, 4:2616
 flame spraying
 characteristics 4:2612, 4:2612*t*
 high-velocity suspension flame spraying (HVSFS) 4:2613
 reactive flame spraying (RFS) 4:2613
 high-velocity oxy-fuel (HVOF)/high-velocity air fuel (HVAF) spraying 4:2612*t*, 4:2615, 4:2626
 laser-hybrid techniques 4:2617, 4:2627, 4:2633*t*
 laser surface melting/remelting (LSM) 4:2626, 4:2633*t*
 liquid feedstock 4:2617
 magnesium alloys 3:2036
 metallic glass coatings 4:2617
 metal matrix composite (MMC) coatings 4:2626–2627
 nanostructured coatings 4:2617
 plasma spraying
 characteristics 4:2612*t*, 4:2614
 high-pressure plasma spraying (HPPS) 4:2615
 inert plasma spraying (IPS) 4:2615
 low-pressure plasma spraying (LPPS) 4:2615
 plasma-transferred arc (PTA) spraying 4:2615
 radio frequency (RF) induction plasma spraying 4:2615
 shrouded plasma spraying (SPS) 4:2614–2615
 supersonic RF plasma spraying 4:2615
 vacuum plasma spraying (VPS) 4:2615
 postprocessing techniques 4:2618
 preprocessing processing techniques 4:2618
 wire arc spraying 4:2612*t*, 4:2613
thermodynamics 1:1–12
 basic concepts
 activity coefficient 1:6
 chemical potential 1:5
 entropy 1:4
 first law of thermodynamics 1:2
 general discussion 1:1
 Gibbs–Duhem equation 1:6
 Gibbs free energy 1:5, 1:8
 second law of thermodynamics 1:3
 terminology 1:2
 chemical potential 1:5, 1:8
 equilibrium activity 1:8
 Gibbs free energy 1:5, 1:8
 spontaneous reactions
 basic concepts 1:7
 reversible cells 1:7
 standard sign conventions 1:12
 steel 3:1702
thermogravimetric analysis (TGA) 3:2393
thermomechanical analysis (TMA) 3:2393
thermoplastic materials
 alkali corrosion 2:1204
 anhydrous hydrogen halide gases/hydrohalic acids 2:1223
 chemically resistant membranes 3:2343
 physical behavior
 amorphous thermoplastics 3:2373, 3:2373*f*
 crystalline thermoplastics 3:2374, 3:2375*f*
 plasticized amorphous thermoplastics 3:2374

- thermoplastic materials (*continued*)
 rubber-modified amorphous plastics 3:2374
 process equipment materials 4:3210, 4:3210f
- thermosetting plastics
 alkali corrosion 2:1204
 amino plastics 3:2384
 anhydrous hydrogen halide gases/hydrohalic acids 2:1223
 epoxy resins 3:2384
 furan resins 3:2341, 3:2342r, 3:2384
 general discussion 3:2384
 phenol-formaldehyde plastics 3:2384
 physical behavior 3:2375
 polyurethanes 3:2384
 silicones 3:2384
 solubility 3:2381
 unsaturated polyesters 3:2384
- Thiobacillus* spp. 2:1179, 2:1180f, 2:1181f, 4:2995, 4:2920
- thiocyanate compounds
 acid pickling 4:2992r
 anodic protection 4:2883
 pitting corrosion 2:774r
- thiourea 4:2490, 4:2490f, 4:2896f, 4:2991, 4:2992r, 4:2993r
- thiozoles 4:2490
- thixocasting techniques 3:2022
- thorium (Th)
 magnesium alloys 3:2014–2015, 3:2019r
 thorium oxide (ThO₂) 1:146r
- tidal marsh environments 3:2087r
- Tillman's formula 3:1752–1753
- timber *see* wood
- time-of-flight diffraction (TOFD) 4:3154
- time-of-flight secondary ion mass spectrometry (TOF-SIMS) 2:1387, 3:2465
see also secondary ion mass spectrometry (SIMS)
- tin (Sn) 3:2068–2077
 alloys
 bearing metals 3:2076
 lead-tin (Pb-Sn) alloys 3:2055, 3:2055r
 magnesium-tin (Mg-Sn) alloys 1:67f
 sacrificial anodes 4:2768–2769
 solders 3:2075
 tin interconnections 3:2076
 applications
 bearing metals 3:2076
 general discussion 3:2069
 solders 3:2075
 tin coatings 3:2074, 4:2525
 tin interconnections 3:2076
 archaeological metals 4:3311f
 atmospheric corrosion 2:848f
 coating characteristics 4:2525
 corrosivity
 acid environments
 mineral acids 3:2073
 organic acids 3:2073
 alkaline conditions 3:2073
 atmospheric environments
 corrosion products 3:2072
 dry air oxidation 3:2072
 humid air corrosion 3:2072
 food products 3:2074
 galvanic corrosion 3:2074, 3:2074r
 near-neutral environments 3:2073
 crystal structure 1:55r
 dental amalgams 2:1310
 electrochemistry
 dissolution kinetics 3:2071
 passivation 3:2071
 Pourbaix diagram 3:2070f
 thermodynamic properties 3:2070, 3:2070f
 electroplated coatings 4:2585
 galvanic corrosion 2:831f, 2:850r, 2:851r, 2:1119f
 galvanizing zinc melts 4:2570
 hot-dipped coatings
 basic concepts 4:2556
 corrosion behavior 4:2564
 general discussion 3:2074
 hot tinning 4:2571
 magnesium alloys 3:2019r
 nitric acid (HNO₃) solutions 2:1252r
 physical properties 3:2054r, 3:2068
 pitting corrosion 2:774r, 2:782f
 standard reduction potential 3:2074r
 Ti18Nb4Sn alloy 2:1314
 tin anode plating 4:2587
 tin bronze 2:831f, 2:1119f, 3:1943
 tin dioxide (SnO₂) 3:2070f, 3:2197f, 3:2321r
 zirconium alloy additions 3:2111
- titanium (Ti) 3:2042–2052
 above-water fastener selection 2:847f
 acetic acid-sodium chloride mixtures 4:3059r
 advanced technical ceramics
 corrosion resistance 3:2285
 silicon carbide/titanium carbide (SiC/TiC) composites 3:2299
 titanium carbide (TiC) 3:2301
 titanium diboride (TiB₂) 3:2301, 3:2302f
- aircraft corrosion
 corrosion behavior 4:3183
 corrosion types 4:3178r
 design guidelines 4:3191r
 fretting corrosion 4:3183
 galvanic corrosion 4:3183
 industrial applications 3:2048
 protective treatments 4:3184r, 4:3189, 4:3190f
 solid-metal embrittlement 4:3183
 stress corrosion cracking (SCC) 4:3183
- alloys
 acid pickling
 hydrochloric acid (HCl) 4:2992r
 nitric acid (HNO₃) 4:2993r
 phosphoric acid (H₃PO₄) 4:2993r
 sulfuric acid (H₂SO₄) 4:2992r
 alkali corrosion 2:1204
 alumina-forming alloys 1:608r, 1:609r
 amorphous alloys 3:2194
 anhydrous hydrogen halide gases/hydrohalic acids 2:1220, 2:1221f
 chromia-forming alloys 1:424f, 1:608r, 1:609r
 chromium-titanium (Cr-Ti) alloys 1:589, 3:2198f, 3:2199f
 cobalt-based alloys 3:1918r
 compositions 1:246r
 corrosion fatigue 2:948
 crevice corrosion 2:760
 electroplated coatings 4:2578
 erosion resistance 2:985f
 ferritic chromium steels 1:501r
 internal corrosion risks 4:3217f
 marine corrosion 2:1120f, 2:1137
 nickel-based superalloys 1:693r
 nickel titanium (NiTi) alloys 2:764, 2:1312–1313, 2:1314
 process equipment materials 4:3210f, 4:3211
 sacrificial anodes 4:2769
 stainless steels 3:1810
 steam and steam/hydrogen environments 1:452, 1:452f, 1:453f
 strength comparisons 3:2388f
 stress corrosion cracking (SCC) 2:867r
 sulfuric acid (H₂SO₄) environments 2:1243, 2:1244f
 uranium-titanium (U-Ti) alloys 3:2182, 3:2182r
- anodic protection 4:2880, 4:2888
 applications
 aerospace industry 3:2048
 biomedical devices 3:2049
 chemical process industry 3:2049
 dental fixtures 3:2049
 general discussion 3:2048
 power generation 3:2049
 seawater and brine applications 3:2048
 below-water fastener selection 2:849f
 ceramics 1:680
 cobalt-based alloys 3:1918r
 corrosion behavior
 fluorine (F) influences 3:2045
 general discussion 3:2044
 hydrogen absorption 3:2046

- oxide films 1:90–91
 pH factors 3:2045
 pitting corrosion 2:774*t*
 temperature effects 3:2045
 crystal structure 1:55*t*
 diffusion coatings 4:2535*t*, 4:2536*t*
 Ellingham diagram 1:652*f*
 exchange current density 3:2217*t*
 galvanic corrosion 2:851*t*, 2:852*t*, 2:1119*f*, 3:1845*f*
 galvanic series 2:831*f*
 galvanizing zinc melts 4:2570
 general discussion 3:2042, 3:2095
 hydrochloric acid (HCl) 4:2883*f*
 laser cladding (LC) 4:2625
 laser surface alloying (LSA) 4:2632, 4:2632*f*
 localized corrosion processes
 crevice corrosion 3:2046
 environmentally-assisted cracking
 general discussion 3:2046
 hydrogen-induced cracking (HIC) 3:2047
 stress corrosion cracking (SCC) 3:2047
 general discussion 3:2046
 pitting corrosion 2:774*t*
 mixed metal oxide (MMO) anodes 4:2796, 4:2814*t*, 4:2815, 4:2822
 molybdenum additives 3:2159
 nitric acid (HNO₃)
 containment materials 2:1254
 corrosion rates 2:1253*t*, 2:1254*t*
 corrosion reactions 2:1252, 2:1252*t*
 nitridation processes 1:400
 phosphoric acid (H₃PO₄) 4:2881
 physical properties 3:2042, 3:2044*t*, 3:2096*t*
 pitting corrosion 2:774*t*
 platinumized titanium anodes 4:2792, 4:2795*t*, 4:2813, 4:2814*t*
 reactive metal pigments 4:2653
 stainless steels 3:1810
 stress corrosion cracking (SCC) 2:867*t*
 sulfuric acid (H₂SO₄)
 corrosion rates 4:2880, 4:2881*f*
 passivation current density 4:2881*f*
 surgical implants
 corrosion resistance 2:763, 2:764, 2:1313, 3:2164
 crevice corrosion 2:1317
 environmental conditions 2:1311, 2:1312*f*
 health effects 2:1310, 2:1310*t*
 historical background 2:1308
 pitting corrosion 2:1317
 titanium nitride (TiN) coatings 2:1316
 Ti15Mo5Zr3Al alloy 2:1313, 3:2164
 Ti18Nb4Sn alloy 2:1314
 Ti6Al2Nb1Ta0.8Mo alloy 2:1313
 Ti6Al4V alloy
 coatings
 laser cladding (LC) 4:2625
 laser gas nitriding (LGS) 4:2632, 4:2632*f*
 laser-hybrid sprayed coating techniques 4:2627
 laser melt/particle injection (LMI) 4:2628
 corrosion fatigue 2:949, 2:1318, 3:2049
 corrosion resistance 2:764, 2:1313
 crevice corrosion 2:1317
 fretting corrosion 2:1318–1319
 galvanic corrosion 2:1319, 3:2278
 historical background 2:1310
 strength comparisons 3:2388*f*
 zirconium (Zr)-based bulk metallic glasses 3:2200
 titanium aluminides (TiAl/Ti₃Al)
 alloyed aluminide coatings 1:665, 1:697
 characteristics 1:649
 chlorine-containing environments 1:661, 1:662*f*
 coatings 1:697
 crystal structure 1:648*f*
 different base–different substrate coatings 1:665
 high-temperature tribocorrosion
 titanium–aluminum (Ti–Al)–ceramic counterfaces 1:362, 1:365*f*
 titanium–aluminum (Ti–Al)–metallic counterfaces 1:360, 1:363*f*, 1:364*f*
 oxidation processes
 general discussion 1:656
 microstructure 1:657–658
 nitrogen influences 1:657
 pretreatment options 1:658
 reactive element additions 1:658, 1:659*f*
 scale properties 1:656, 1:656*f*
 steam and steam/hydrogen environments 1:452, 1:452*f*, 1:453*f*
 water vapor effects 1:658
 phase diagram 1:651*f*
 sulfur-containing environments 1:660, 1:661*f*
 thermal expansion coefficients 1:145*f*
 uranium alloys 3:2188
 titanium beryllide (FeBe₂) 3:2177
 titanium beryllide (FeBe₁₂) 3:2173, 3:2173*f*
 titanium carbide (TiC) 1:680, 3:2301
 titanium diboride (TiB₂) 1:680, 3:2251, 3:2301, 3:2302*f*
 titanium dioxide (TiO₂)
 amorphous alloys 3:2197*f*
 corrosion-resistant coatings 4:2995
 enamel frit compositions 3:2321*t*, 3:2331*t*
 fracture toughness values 1:168*t*
 glass compositions 3:2308*t*
 intermetallic alloys 1:652*f*, 1:656, 1:656*f*
 oxidation tendencies 1:389*f*
 oxide basicity 1:477*f*
 Pilling–Bedworth ratio (PBR) 1:146*t*, 1:160*t*
 Poisson ratios 1:170*t*
 scale failure strain measurements 1:167*t*
 stress growth measurements 1:159*t*
 superheater deposit composition 1:464*t*
 thermal expansion coefficients 1:145*f*
 titanium molybdenum (TiMo) alloys 2:1312–1313
 titanium niobium (TiNb) alloys 2:1312–1313
 titanium nitride (TiN)
 ceramics 1:680
 coatings 2:1316, 2:1319, 4:2632
 corrosion resistance 1:680
 historical background 2:1308
 nitridation processes
 computer simulation modelling 1:314*f*
 diffusion-controlled internal nitridation 1:306
 general discussion 1:314
 internal nitridation processes 1:260, 1:309, 1:309*f*, 1:310*f*
 iron- and nickel-based superalloys 1:310, 1:311*f*
 laser gas nitriding (LGS) 4:2632
 mechanical/kinetic effects 1:311, 1:312*f*
 thermodynamic stability 1:308, 1:308*f*
 oral cavity environment 2:1312–1313
 thermal expansion coefficients 1:145*f*
 titanium oxide (Ti₂O₃) 1:652*f*
 titanium oxide (Ti₃O₅) 1:652*f*
 titanium oxide (Ti₄O₇) 1:652*f*
 titanium oxide (TiO) 1:410*f*, 1:542*f*, 1:652*f*
 titanium silicide (Ti₅Si₃) 1:209, 1:702, 1:703*f*
 titanium silicide (TiSi₂) 1:145*f*, 1:209
 toluene 3:2380*t*
 toluene di-isocyanate (TDI) 3:1909
 tomato juice 3:1773*t*
 topsides 4:2699, 4:2699*t*
 transformation toughened partially stabilized zirconia 3:2294
 transgranular corrosion 2:866*f*
 transmission electron microscopy (TEM)
 basic concepts 2:1412
 bright field (BF) images 2:1413–1414, 2:1414*f*
 cementite analysis 1:286, 1:287*f*
 convergent beam electron diffraction (CBED) 2:1417
 corrosion product characterizations 1:140, 1:142*f*
 corrosion studies 2:1406, 2:1406*f*
 dark field (DF) images 2:1413–1414, 2:1414*f*
 electron beam damage effects 2:1415, 2:1415*f*
 electron diffraction 2:1417, 2:1417*f*
 ‘glaze’ formation analyses 1:379, 1:381*f*, 1:383
 high angle annular dark field (HAADF) images

- transmission electron microscopy (TEM) (*continued*)
 aluminum alloy cross-section 2:141*f*
 Nimonic alloys–Stellite 6 wear-affected surfaces study
 aluminum oxide segregation 1:387*f*
 'glaze' formation 1:382*f*, 1:383, 1:384*f*
 sliding wear comparisons 1:388*f*
 wear effects 1:385*f*, 1:386*f*
 high-resolution transmission electron microscopy (HRTEM) 2:1415, 2:1416*f*
 nickel graphitization 1:294, 1:295*f*
 scanning transmission electron microscopy (STEM)
 characteristics 2:1416
 Nimonic alloys–Stellite 6 wear-affected surfaces study
 aluminum oxide segregation 1:387*f*
 'glaze' formation 1:382*f*, 1:383, 1:384*f*
 sliding wear comparisons 1:388*f*
 wear effects 1:385*f*, 1:386*f*
 selected area diffraction (SAD) 2:1417
 specimen preparation techniques 2:1415*f*, 2:1424, 2:1425*f*
 TEM tomography 2:1416
 X-ray analyses 2:1418–1419, 2:1419*f*, 2:1420*f*
 trench lining 3:2346
 tribocorrosion 2:1005–1050
 applications
 bio-tribocorrosion
 dentistry 2:1046*t*
 dentistry 2:1045
 replacement joints 2:1046, 2:1046*f*, 2:1047*f*
 chemical mechanical polishing (CMP) 2:1043, 2:1043*f*
 erosion-corrosion 2:1044, 2:1044*f*, 2:1045*f*
 general discussion 2:1043
 asperity–asperity interactions 2:1009, 2:1009*f*
 background information 2:1007
 basic concepts
 corrosion/electrochemical reactions
 critical velocity concept 2:1017, 2:1019*f*, 2:1019*t*
 depassivation kinetics 2:1016, 2:1016*f*, 2:1017*f*, 2:1018*t*, 2:1040
 flow corrosion 2:1019, 2:1021*f*
 repassivation kinetics 2:1016, 2:1016*f*, 2:1018*f*, 2:1018*t*, 2:1040
 tribofilms 2:1015
 wear–corrosion interactions 2:1018*f*
 experimental techniques 2:1028, 2:1029*t*
 influencing factors
 environmental conditions 2:1011, 2:1012*f*, 2:1013*f*
 flow corrosion rate–flow velocity relationship 2:1011, 2:1011*f*
 friction 2:1014
 general discussion 2:1010
 material parameters 2:1009*f*, 2:1010, 2:1010*t*
 wear fundamentals
 abrasion 2:1028, 2:1028*f*
 cavitation erosion 2:1025, 2:1026*f*, 2:1027*f*
 solid particle erosion 2:1021, 2:1022*f*, 2:1023*f*, 2:1024*f*, 2:1025*f*, 2:1026*f*
 cavitation corrosion 2:1008, 2:1008*f*
 definitions 2:1008
 general discussion 2:1048
 high-temperature tribocorrosion 1:331–398
 tribocorrosion mechanisms
 mechanical–electrochemical interactions
 abrasion–corrosion 2:1031, 2:1032*f*, 2:1033*f*, 2:1034*f*, 2:1038*f*
 erosion–corrosion 2:1029, 2:1030*f*, 2:1037*t*, 2:1038, 2:1038*f*, 2:1041*t*
 near-wall turbulence 2:1031, 2:1031*f*
 positive–negative interactions 2:1041*t*
 sliding wear–corrosion 2:1033, 2:1040
 synergy processes 2:1040, 2:1041*t*
 wear–corrosion interactions
 enhanced surface degradation mechanisms 2:1034, 2:1036*f*, 2:1037*f*, 2:1037*t*, 2:1038*f*
 erosion–corrosion 2:1038
 flow velocities 2:1040*t*
 positive–negative interactions 2:1041*t*
 potential particle kinetic energies 2:1040*t*
 sliding wear–corrosion 2:1040
 synergy processes 2:1040, 2:1041*t*
 tribofilms 2:1015
 tricalcium aluminate (C₃A) 3:2350*t*, 3:2351
 tricalcium phosphate (Ca₃(PO₄)₂) 4:2942*t*
 trichloroacetic acid 3:1998–1999
 trichloroethane (CH₃CCl₃) 2:1067*f*
 trichloroethene 3:2380*t*
 trichloromethane 3:2380*t*
 troilite (FeS) 4:2942*t*
 troilite (FeS) 2:1288, 2:1288*t*, 2:1289*f*
 troposphere 2:1052
 tubing glass 3:2307, 3:2308*t*, 3:2309*t*
 tungsten (W) 3:2151–2156
 alloys
 alumina-forming alloys 1:608*t*, 1:609*t*
 aluminum–tungsten (Al–W) alloys 3:2194*f*, 3:2195–2196
 amorphous alloys 3:2155, 3:2193–2194, 3:2194*f*
 chemical compositions 1:246*t*, 3:2153*t*
 chromia-forming alloys 1:608*t*, 1:609*t*
 cobalt-based alloys 3:1918, 3:1918*t*
 cobalt–chromium–tungsten (Co–Cr–W) system 3:1920
 general discussion 3:2153
 intermetallic alloys 1:656, 1:658
 nickel-based superalloys 1:693*t*
 anodic protection 4:2874*t*
 applications 3:2152
 corrosivity
 corrosion processes
 aqueous corrosion 3:2155
 dissolvable implants 3:2155
 high-temperature oxidation 3:2155
 liquid metals 3:2156
 oxide removal/cleaning 3:2154
 planarization/chemomechanical polishing 3:2155
 electrochemistry
 anodic dissolution 3:2154
 potential–pH (Pourbaix) diagram 3:2154*f*
 thermodynamics 3:2153
 crystal structure 1:55*t*
 diffusion coatings 4:2548*t*
 fabrication processes 3:2152
 metal–matrix composites 3:2251
 occurrence 3:2151
 oxidation processes 1:204*f*, 1:205, 1:205*f*
 physical properties 3:2054*t*, 3:2136*t*
 properties 3:2151
 surgical implants 3:2155
 tungsten carbide (WC) 3:1920, 3:2152, 3:2301
 tungsten oxide (WO₃) 1:146*t*, 1:204*f*, 1:205, 1:477*f*, 3:2197*f*
 TZP (tetragonal zirconia polycrystals) 3:2294
- ## U
- UK Onshore Pipeline Association (UKOPA) 4:3273
 ultrahigh pressure water jetting 4:2492
 ultrahigh-temperature ceramics 1:680
 ultrahigh vacuum (UHV) conditions 2:1376, 2:1377*f*
 ultrasonic cleaning 4:2491
 ultraviolet photoelectron spectroscopy (UPS)
 basic concepts 2:1382
 characteristics 2:1376*t*
 energy diagram 2:1383*f*, 2:1384*f*
 unalloyed cast irons
 alkali corrosion 3:1768*f*, 3:1768*t*
 characteristics 3:1747
 corrosion rates 3:1760*f*, 3:1761*f*
 gaseous environments 3:1785*t*, 3:1786*t*
 hydrogen sulfide (H₂S) corrosion 3:1784*t*
 natural water corrosion 3:1756*t*
 seawater corrosion 3:1759*t*
 underbody protection 4:3173
 undercutting 4:2744
 underground corrosion 3:2062
see also buried and ground-contact structures; soil corrosion
 underground structures 2:768
 underwater hulls 4:2691, 4:2692*t*
 unified numbering system (UNS) 4:3053
 uniform corrosion 2:725–730
 aqueous carbon dioxide (CO₂) corrosion 2:1286
 biomedical devices 2:1316

- carbon steel 3:1710
 characteristics 1:95*t*, 2:1633, 3:1838
 copper/copper alloys 2:729
 corrosion characteristics 2:727
 corrosion management 4:3010
 corrosion risk mitigation 4:3056
 electrochemical kinetics 2:726, 2:726*f*
 industrial heating and cooling systems 4:2945
 iron compounds 2:728
 passive films 2:727
 thermodynamics 2:725
 zinc/zinc alloys 2:730
 unsaturated polyesters 3:2384
 uranium (U) 3:2181–2191
 alloys 3:2182, 3:2182*t*
 applications 3:2182
 aqueous corrosion
 oxidation rates 3:2183, 3:2184*f*
 potential–pH (Pourbaix) diagram 3:2183*f*, 3:2184*f*
 thermodynamics 3:2183
 water corrosion 3:2183, 3:2184*f*
 water radiolysis 3:2185
 water vapor effects 3:2185
 atmospheric corrosion 3:2185
 background information 3:2181
 corrosion processes
 environmental conditions 3:2190
 irradiation effects 3:2189
 protective coatings 3:2188
 uranium oxide (UO₂) dissolution 3:2189
 galvanic corrosion 3:2186
 high-temperature gas reactions
 carbon dioxide (CO₂)/carbon monoxide (CO) 3:2184*f*, 3:2187
 oxidation reactions 3:2184*f*, 3:2187
 steam/water vapor interactions 3:2188
 hydrated uranium oxide (UO₃) 3:2183, 3:2185
 metallurgical properties 3:2182
 nitric acid (HNO₃) solutions 2:1252*t*
 properties 3:2182, 3:2182*t*
 stress corrosion cracking (SCC) 3:2186
 triuranium octoxide (U₃O₈) 3:2187
 uranium carbide (UC) 3:2187
 uranium dioxide (UO₂)
 corrosion processes 3:2189
 formation processes 3:2183, 3:2187
 potential–pH (Pourbaix) diagram 3:2184*f*
 water radiolysis 3:2185
 uranium hydride (UH₃)
 formation processes 3:2183
 potential–pH (Pourbaix) diagram 3:2184*f*
 urea
 organic inhibitors 4:2490
 zirconium corrosivity 3:2125
 urethane crosslinking system 3:2437
 urine bile research 2:1312*f*
- V**
- vacuum–oxygen decarburization (VOD) 3:1882
 vacuum plasma spraying (VPS) 4:2615
 vanadium (V)
 corrosion potential 2:1261
 corrosion-resistant alloys
 health effects 2:1310, 2:1310*t*
 historical background 2:1308
 crystal structure 1:55*t*
 diffusion coatings 4:2535*t*, 4:2536*t*
 fireside corrosion 1:470, 1:470*f*, 1:471*f*, 1:472*f*
 fuel chemistry 1:459, 1:459*t*
 galvanizing zinc melts 4:2570
 intermetallic alloys 1:656, 1:662
 nitric acid (HNO₃) solutions 2:1252*t*
 oil-fired boiler corrosion 1:404
 quaternary/ternary iron–chromium (Fe–Cr) alloy systems 3:2245
 stainless steels 3:1811
 Ti6Al4V alloy
 coatings
 laser cladding (LC) 4:2625
 laser gas nitriding (LGS) 4:2632, 4:2632*f*
 laser-hybrid sprayed coating techniques 4:2627
 laser melt/particle injection (LMI) 4:2628
 corrosion fatigue 2:949, 2:1318, 3:2049
 corrosion resistance 2:764, 2:1313
 crevice corrosion 2:1317
 fretting corrosion 2:1318–1319
 galvanic corrosion 2:1319, 3:2278
 historical background 2:1310
 strength comparisons 3:2388*f*
 zirconium (Zr)-based bulk metallic glasses 3:2200
 vanadium beryllide (VBe₂) 3:2177
 vanadium pentoxide (V₂O₅) 1:1464, 1:404, 1:461, 1:464*t*, 1:465*f*
 van't Hoff isotherm 1:8
 vapor degreasing 4:2484
 vapor phase corrosion inhibitors 4:2997
 varnishes 4:2668*t*, 4:2675, 4:2675*t*, 4:2995*t*
 vat plating 4:2597
 vats 3:2443–2444
 very large crude carriers (VLCCs) 4:2684*t*, 4:2685, 4:2690*f*
 vinegar 3:1773*t*
 vinyl acetate 3:2371
 vinyl chloride monomer (VCM) 3:1886–1887, 3:1908, 3:2371
 vitreous carbon 3:2273, 3:2275*t*, 3:2276
 vitreous enamel coatings 3:2330–2336
 characteristics 3:2330, 3:2331*t*
 corrosion-resistant properties
 abrasion resistance 3:2333*t*
 chemical resistance
 acid resistance 3:2334
 alkali resistance 3:2335
 atmospheric resistance 3:2335
 detergent resistance 3:2335
 general discussion 3:2333
 water resistance 3:2335
 mechanical properties 3:2332, 3:2332*t*, 3:2333*t*
 thermal properties 3:2333
 glass-lined steel equipment manufacturing processes
 certifications and standards 3:2322, 3:2322*t*, 3:2323*t*
 glass formulations 3:2319, 3:2321*f*, 3:2321*t*
 glass preparation 3:2321
 lining process 3:2323
 metal preparation 3:2322
 metal/metal preparation
 application and fusion processes 3:2332
 cast iron 3:2331
 enamel bonding 3:2332
 steel 3:2331
 pipeline corrosion management 4:2812*t*, 4:3283, 4:3283*t*
 vitreous silica
 applications 3:2316
 characteristics 3:2314
 chemical attack resistance
 alkaline solutions 3:2315
 basic oxides 3:2316
 boiling water/steam 3:2315
 fluorine corrosion 3:2315
 general discussion 3:2315
 hydrofluoric acid (HF) 3:2315
 metal reaction products 3:2316
 pH 3:2316*f*
 electrical characteristics 3:2315
 heat resistance 3:2315
 manufacturing processes 3:2314
 polymorphic structure 3:2314, 3:2315*f*
 thermal conductivity 3:2315
 thermal expansion coefficients 3:2314
 vivianite 4:2497*t*
 volatile organic compounds (VOCs) 3:2061
 Volmer–Heyrovsky mechanism 1:20, 2:904, 2:1607
 Volmer–Tafel mechanism 2:904, 2:1607
 vulcanization
 basic concepts 3:2417
 general discussion 3:2435
 metallic oxide vulcanization 3:2437

- vulcanization (*continued*)
 peroxide vulcanization 3:2436
 quinonodioximes vulcanization 3:2437
 resin vulcanization 3:2437
 rubber-to-metal bonding
 hot air/ambient temperature technique 3:2421
 steam pressure technique 3:2421
 system characteristics 3:2418*t*
 water curing technique 3:2421
 sulfur vulcanization
 basic concepts 3:2417
 conjugated diene and triene groups 3:2436
 cyclic sulfides 3:2436
 disulfidic crosslink 3:2436
 extra-network material 3:2436
 monosulfidic crosslink 3:2436
 pendent accelerator groups 3:2436
 polysulfidic crosslink 3:2436
 system characteristics 3:2418*t*
 system characteristics 3:2418*t*
 urethane crosslinking system 3:2437
- W**
- Wagner number 2:840, 2:842*f*
 Wagner's theory of internal oxidation
 alloy design requirements 1:543, 1:543*f*
 chromium alloys 1:490
 kinetics laws 1:137
 nitridation processes 1:306, 1:306*f*
 pure metal reactions 1:188, 1:189*f*
 silicon carbide (SiC) 1:676–677, 1:676*f*
 Wagner–Traud theory of metallic corrosion 2:1603–1604
 walnut 2:1325*t*
 washer test 2:846*f*
 waste-fired boilers 1:326, 1:327*f*, 1:328*f*
 waste incineration corrosion 1:326, 1:327*f*, 1:328*f*, 1:477, 1:479*f*
 wastewater treatment
 corrosion conditions
 chemical additives 3:1871
 chloride concentration effects 3:1871
 microbially-induced corrosion (MIC) 3:1871
 field exposure results
 base material welds 3:1872, 3:1874*t*
 chemical compositions 3:1864*t*, 3:1872*t*
 general discussion 3:1872
 localized corrosion 3:1873*f*
 open circuit potential (OCP) time dependence 3:1873*f*
 general discussion 3:1870
 purification methods
 biological treatments 3:1871
 chemical treatments 3:1871
 digestion processes 3:1871
 final settling processes 3:1871
 general discussion 3:1870
 mechanical treatments 3:1870
 schematic diagram 3:1870*f*
 water cooling towers 2:1328, 3:2444
 water (H₂O)
 alkalinity 4:2939, 4:2939*t*, 4:2940*t*, 4:2953, 4:2958
 ammonia–nitric acid–sulfuric acid–water (NH₃–HNO₃–H₂SO₄–H₂O)
 systems 2:1058
 ammonia–nitric acid–water (NH₃–HNO₃–H₂O) systems 2:1058
 aqueous carbon dioxide (CO₂) corrosion 2:1279
 atmospheric gases 2:1053*t*
 chemical characteristics 4:2936, 4:2939*t*
 combustion conditions 1:461*f*
 concrete 3:2356
 drinking water 3:1853
 enamel frit compositions 3:2331*t*
 flue gas composition 1:460*t*, 1:462*t*, 1:463*t*
 freshwater consumption 4:2932, 4:2935*f*
 freshwater environments
 copper corrosion
 pipework systems 3:1954
 pitting corrosion 3:1954
 iron–nickel (Fe–Ni) alloys 3:1791
 stainless steel corrosion 3:1853, 3:1854*f*
 steel corrosion 3:1729, 3:1730*t*
 hardness 4:2940–2941, 4:2953, 4:2958
 heat capacity 4:2931
 hydrologic cycle 4:2936, 4:2937*f*
 ionizing radiation effects 2:1331, 2:1332*t*
 iron corrosion 2:830*f*
 latent heat 4:2932
 lead corrosivity
 condensed water 3:2061
 distilled water 3:2061
 natural waters 3:2061
 molecular structure 4:2582*f*
 natural waters 2:1094–1106
 cast iron corrosion
 corrosion rates 3:1754, 3:1756*f*, 3:1756*t*
 dissolved oxygen effects 3:1753, 3:1755*f*
 galvanic corrosion 3:1756, 3:1757*t*
 general discussion 3:1752
 inhibitors 3:1757
 water aggressiveness and corrosiveness 3:1752, 3:1754*f*, 3:1754*t*
 constituents/impurities
 carbon dioxide (CO₂) 2:1097, 2:1097*f*, 3:1754*f*
 dissolved gases 2:1096
 hardness 2:1097
 metallic constituents 2:1095
 mineral analyses 2:1095, 2:1096*t*
 minor inorganic species 2:1098, 2:1098*t*
 organic species 2:1099
 oxygen (O) 2:1096, 2:1097*t*, 3:1753, 3:1755*f*
 permissible limits 2:1098*t*
 corrosion test methods 2:1506, 2:1507*f*
 corrosivity
 bacteriological effects 2:1105
 copper corrosivity 3:1950, 3:1954
 general discussion 2:1104
 lead corrosivity 3:2061
 pH 2:1104
 physical processes 2:1105
 pitting corrosion 3:1954
 water chemistry 2:1105
 fouling deposits
 biofilms 2:1103
 corrosion 2:1103
 general discussion 2:1103
 steel corrosion 3:1728
 scale formation
 calcium carbonate (CaCO₃) scales 2:1100, 2:1101*f*
 calcium phosphate (Ca₁₀(OH)₂(PO₄)₆) 2:1102
 calcium sulfate (CaSO₄) 2:1102
 controlling factors 2:1099, 2:1099*f*
 fouling deposits 2:1103
 inorganic species 2:1102
 iron compounds 2:1102
 magnesium compounds 2:1102
 manganese compounds 2:1102
 silica 2:1102
 steel corrosion 3:1728
 water treatment 2:1103
 stainless steel corrosion
 chlorination effects 3:1852, 3:1852*f*
 drinking water 3:1853
 freshwater 3:1853, 3:1854*f*
 general discussion 3:1851
 microbially-induced corrosion (MIC) 3:1851, 3:1852*f*
 river waters 3:1853
 seawater 3:1854, 3:1855*t*
 steel corrosion
 accelerated low water corrosion (ALWC) 3:1729
 corrosion rates 3:1728, 3:1729*t*
 height-related corrosion 3:1730, 3:1731*f*
 piped fresh water systems 3:1729, 3:1730*t*
 unprotected structural steel 3:1729
 water treatment
 acid additions 2:1103
 scale inhibitors/dispersants 2:1104

- surfactants 2:1104
 - water softening/water hardening 2:1103
- zinc/zinc alloy corrosion 3:2083
- pack aluminizing process 4:2537*t*
- potential-pH (Pourbaix) diagram
 - aluminum-water system 2:1192*f*
 - iron-water system 2:1193*f*
 - nickel-water system 2:1201*f*
- reduction reactions 2:1279
- river waters 3:1853
- rubber and synthetic elastomers 3:2429, 3:2430*f*, 3:2431*f*
- seawater-cooled circulating water systems
 - cathodic protection
 - continuous anodes 4:2822
 - current requirements 4:2812*t*
 - galvanic anodes 4:2822
 - impressed current anodes 4:2822
 - impressed-current systems 4:2823
 - rod anodes 4:2822
 - tubular anodes 4:2822
- soil interactions
 - capillary water 2:1156
 - free ground water 2:1156
 - gravitational water 2:1156
 - significance 2:1155
- solid oxide fuel cells (SOFCs) 1:488, 1:489*f*, 1:497*t*
- solubility parameters 3:2380*t*
- steam and steam/hydrogen environments 1:407-456
 - argon-water vapor ($\text{Ar-H}_2\text{O}$) atmospheres 1:408, 1:410*f*, 1:412*f*
 - basic concepts 1:408
 - chromium/chromium-based alloys
 - chromia (Cr_2O_3) scale growth mechanisms 1:419, 1:421*f*
 - chromia-forming iron- and nickel-based alloys 1:418, 1:420*f*
 - commercial chromia-forming iron- and nickel-based alloys 1:422, 1:422*f*, 1:423*f*
 - minor alloying element addition effects 1:423, 1:424*f*, 1:425*f*, 1:426*f*
 - oxidation processes 1:418
 - spalling tendencies 1:419*f*
 - surface morphologies 1:423*f*
 - weight change comparisons 1:419*f*, 1:420*f*
- environmental conditions
 - breakaway oxidation mechanisms 1:428*f*, 1:430
 - external chromia scale formation 1:427, 1:429*f*
 - internal oxidation 1:427, 1:428*f*
 - nonprotective oxidation 1:426
- ferritic and austenitic stainless steels
 - construction materials 1:432*t*
 - general discussion 1:431
 - inner scale formation 1:443*f*
 - long-term behavior 1:436, 1:437*f*, 1:438*f*, 1:439*f*
 - oxidation rates 1:440*f*, 1:441*f*, 1:442*f*
 - pressure effects 1:449, 1:450*f*
 - scale growth rate 1:445, 1:445*f*
 - scale morphology 1:447*f*, 1:448*f*, 1:449*f*, 1:450*f*
 - spalling tendencies 1:439*f*
 - steam oxidation mechanisms 1:433, 1:434*f*, 1:435*f*
 - temperature dependence effects 1:440, 1:440*f*, 1:441*f*, 1:442*f*, 1:443*f*, 1:445*f*
 - time-based mass change 1:446*f*
 - void and gap formation 1:435, 1:436*f*, 1:437*f*, 1:438*f*, 1:439*f*
 - weight change comparisons 1:433*f*, 1:442*f*, 1:444*f*
- metallic high-temperature components
 - alumina-forming alloys and coatings 1:449
 - borderline alloys 1:426
 - chromium/chromium-based alloys 1:418
 - environmental conditions 1:426
 - ferritic and austenitic stainless steels 1:431
 - general discussion 1:416
 - nomenclature 1:417
 - protective scale-forming elements (PSEs) 1:416, 1:417*f*
- nomenclature 1:408
- oxide scale growth
 - lattice diffusion 1:415
 - molecular diffusion 1:415, 1:416*f*, 1:417*f*
 - oxidation rate-hydration enthalpy relationship 1:415*f*
 - surface reaction kinetics 1:413, 1:414*f*
- solid oxide fuel cells (SOFCs) 1:488, 1:489*f*
- thermodynamics
 - argon-water vapor ($\text{Ar-H}_2\text{O}$) atmospheres 1:410*f*, 1:412*f*
 - equilibrium oxygen partial pressure 1:409*f*, 1:410*f*, 1:412*f*
 - gas atmospheres 1:409, 1:409*f*, 1:410*f*
 - material testing considerations 1:411, 1:412*f*, 1:413*f*
 - solid oxide stability 1:409
 - temperature dependence effects 1:411*f*
 - volatile reaction products 1:409, 1:411*f*
- uranium compounds 3:2188
- vitreous silica 3:2315
- steel corrosion
 - natural waters
 - accelerated low water corrosion (ALWC) 3:1729
 - corrosion rates 3:1728, 3:1729*t*
 - height-related corrosion 3:1730, 3:1731*f*
 - piped fresh water systems 3:1729, 3:1730*t*
 - unprotected structural steel 3:1729
 - process waters
 - boiler waters 3:1731
 - heating and cooling systems 3:1730, 3:1731*t*
- sulfuric acid-ammonia-water ($\text{H}_2\text{SO}_4\text{-NH}_3\text{-H}_2\text{O}$) systems 2:1057, 2:1058*f*
- water-based lubricants 2:1306
- water corrosion
 - advanced material wear 1:373
 - alumina-forming alloys 1:553, 1:553*t*, 1:637, 1:638*f*
 - aluminum alloys 3:1997
 - automotive bodywork 4:3169
 - chromia-forming alloys 1:553, 1:553*t*
 - copper/copper alloys
 - brass dezincification 3:1952
 - chemical attacks 3:1956, 3:1956*f*
 - contaminated environments 3:1960
 - dissolution conditions 3:1957
 - freshwater environments 3:1954
 - hot soft water conditions 3:1955
 - impingement attacks 3:1950, 3:1951*f*, 3:1952*t*
 - microbially-induced corrosion (MIC) 3:1956, 3:1957*f*
 - natural waters 3:1950
 - pitting corrosion 3:1954
 - seawater 3:1952*t*, 3:1958
 - selective attacks 3:1954
 - stress corrosion cracking (SCC) 3:1957, 3:1957*f*
 - glasses 3:2313
 - glass linings and coatings 3:2325
 - high-temperature oxidation 1:553, 1:553*t*
 - hot-dipped zinc coatings 4:2562, 4:2562*t*
 - iron and steel 4:2668, 4:2668*t*
 - nickel/nickel alloys 1:98*f*
 - steel
 - accelerated low water corrosion (ALWC) 3:1729
 - boiler waters 3:1731
 - deposits and scales 3:1728
 - dissolved gases 3:1726
 - dissolved solids 3:1727
 - fouling deposits 3:1728
 - heating and cooling systems 3:1730, 3:1731*t*
 - height-related corrosion 3:1730, 3:1731*f*
 - microbial effects 3:1728
 - natural waters 3:1728, 3:1729*t*
 - piped fresh water systems 3:1729, 3:1730*t*
 - process waters 3:1730
 - under-deposit corrosion 3:1728
 - unprotected structural steel 3:1729
 - water composition 3:1726
 - tin corrosivity 3:2073
 - uranium (U) 3:2183, 3:2184*f*
 - vitreous enamel coatings 3:2335
 - water radiolysis 3:2185
 - water vapor effects 3:2185
- water system modifications 4:2930-2970
 - chemical inhibitors
 - cooling systems 4:2964, 4:2965*t*, 4:2968*f*
 - general discussion 4:2961
 - steam boiler systems 4:2961

- water (H₂O) (*continued*)
- closed-loop water systems 4:2943
 - cooling systems 4:2964, 4:2965*t*, 4:2968*f*
 - corrosion mechanisms
 - concentrated cell/crevice corrosion 4:2947
 - condensate line corrosion 4:2948
 - crevice corrosion 2:766
 - erosion 4:2948
 - galvanic corrosion 4:2946
 - general discussion 4:2945
 - grooving corrosion 4:2948
 - impingement attacks 4:2948
 - microbially-induced corrosion (MIC) 4:2949, 4:2949*f*, 4:2967, 4:2969*t*
 - pitting corrosion 4:2945, 4:2946*f*
 - stress corrosion 4:2947
 - uniform corrosion 4:2945
 - white rust 4:2949
 - heat capacity 4:2931
 - importance 4:2931
 - industrial heating and cooling systems
 - alkalinity 4:2939, 4:2939*t*, 4:2940*t*, 4:2953, 4:2958
 - bacterial growth count evaluation 4:2969*t*
 - blistering 4:2958*f*
 - chemical inhibitors 4:2961
 - contaminant cycles of concentration (COC) 4:2959*t*, 4:2960, 4:2961*t*
 - contaminant saturation conditions 4:2956
 - cooling systems 4:2964, 4:2965*t*, 4:2968*f*
 - corrosion mechanisms 4:2945
 - corrosion mitigation 4:2933, 4:2936*f*
 - corrosion monitoring 4:3143
 - corrosion rate quantification 4:2957*t*
 - corrosion test coupon 4:2956*f*
 - corrosion vulnerability data 4:2956*t*
 - freshwater consumption 4:2932, 4:2935*f*
 - hardness 4:2940–2941, 4:2953, 4:2958
 - hydrologic cycle 4:2936, 4:2937*f*
 - Langelier saturation index (LSI) 4:2958
 - Larson–Skold index (L–SI) 4:2960
 - makeup water treatment 4:2959*t*
 - metal and alloy materials selection 4:2955, 4:2956*t*
 - microbially-induced corrosion (MIC) 4:2967, 4:2969*t*
 - microbiological fouling 4:2950, 4:2950*f*, 4:2967, 4:2969*t*
 - mineral scales, muds, and sludges 4:2941, 4:2942*f*, 4:2942*t*, 4:2943*f*
 - organic inhibitors 4:2966, 4:2966*f*
 - pathogenic bacteria 4:2951, 4:2951*f*
 - pretreatment processes 4:2953, 4:2954*f*
 - Puckorius scaling index (PSI) 4:2959
 - Ryznar stability index (RSI) 4:2959
 - scale formation 4:2935, 4:2936*f*
 - steam boiler systems 4:2961
 - treatment guidelines 4:2952
 - water chemistry 4:2936, 4:2939*t*
 - water treatment factors 4:2933
 - latent heat 4:2932
 - new-construction HVAC systems 4:2944
 - organic inhibitors 4:2966, 4:2966*f*
 - potable systems
 - alkalinity 4:2939, 4:2939*t*, 4:2940*t*, 4:2953, 4:2958
 - bacterial growth count evaluation 4:2969*t*
 - blistering 4:2958*f*
 - chemical inhibitors 4:2961
 - contaminant cycles of concentration (COC) 4:2959*t*, 4:2960, 4:2961*t*
 - contaminant saturation conditions 4:2956
 - corrosion mechanisms 4:2945
 - corrosion mitigation 4:2933, 4:2936*f*
 - corrosion rate quantification 4:2957*t*
 - corrosion test coupon 4:2956*f*
 - corrosion vulnerability data 4:2956*t*
 - freshwater consumption 4:2932, 4:2935*f*
 - hardness 4:2940–2941, 4:2953, 4:2958
 - hydrologic cycle 4:2936, 4:2937*f*
 - Langelier saturation index (LSI) 4:2958
 - Larson–Skold index (L–SI) 4:2960
 - makeup water treatment 4:2959*t*
 - metal and alloy materials selection 4:2955, 4:2956*t*
 - microbially-induced corrosion (MIC) 4:2967, 4:2969*t*
 - microbiological fouling 4:2950, 4:2950*f*, 4:2967, 4:2969*t*
 - mineral scales, muds, and sludges 4:2941, 4:2942*f*, 4:2942*t*, 4:2943*f*
 - organic inhibitors 4:2966, 4:2966*f*
 - pathogenic bacteria 4:2951, 4:2951*f*
 - pretreatment processes 4:2953, 4:2954*f*
 - Puckorius scaling index (PSI) 4:2959
 - Ryznar stability index (RSI) 4:2959
 - scale formation 4:2935, 4:2936*f*
 - steam boiler systems 4:2961
 - treatment guidelines 4:2952
 - water chemistry 4:2936, 4:2939*t*
 - water treatment factors 4:2933
 - wear–corrosion
 - cobalt/cobalt alloys 3:1928, 3:1931, 3:1932*f*
 - tribocorrosion mechanisms
 - enhanced surface degradation mechanisms 2:1034, 2:1036*f*, 2:1037*f*, 2:1037*t*, 2:1038*f*
 - erosion–corrosion 2:1038
 - flow velocities 2:1040*t*
 - positive–negative interactions 2:1041*t*
 - potential particle kinetic energies 2:1040*t*
 - sliding wear–corrosion 2:1033, 2:1040
 - synergy processes 2:1040, 2:1041*t*
 - weathering steels *see* low-alloy steel
 - Weibull distribution model 2:1554
 - weld corrosion 4:2914*f*, 4:2915*f*, 4:2914, 4:3293
 - weld decay
 - austenitic stainless steels 2:818, 2:818*f*
 - characteristics 1:95*t*
 - welded joints
 - fusion welding 2:1448, 3:2452*t*, 3:2453*f*
 - resistance welding 3:2452*t*, 3:2453*f*
 - solid-phase welding 3:2452*t*
 - weld defects 3:2453, 3:2453*f*, 3:2454*f*, 3:2454*t*
 - welding processes 3:2452, 3:2452*t*, 3:2453*f*
 - weldment corrosion factors
 - filler metal composition 3:2455
 - general discussion 3:2453
 - postweld heat treatment (PWHT) 3:2455
 - residual stresses 3:2455, 3:2455*f*
 - welding technique 3:2454
 - weld joint design 3:2453, 3:2455*f*
 - Wenner four-pin earth resistivity meter 4:2842, 4:2843*f*
 - Westergaard functions 1:82–83
 - western red cedar 2:1325*t*
 - wet-rot fungi 3:2445
 - wet storage stain 4:2563–2564
 - wetting agents 4:2653
 - Whipple–Le Claire diffusion model 1:138
 - white cast iron 3:1739, 3:1751*t*
 - white rust 3:2083, 4:2563–2564, 4:2949
 - Wiener process modeling 2:1555
 - Wilkinson–Vick model 2:1655
 - wire arc spraying 4:2612*t*, 4:2613
 - wire-on-bolt/CLIMAT test 2:846*f*, 2:847
 - wood 2:1323–1329, 3:2439–2446
 - above-water fastener selection 2:847*f*
 - background information 3:2439
 - below-water fastener selection 2:849*f*
 - composition 2:1323
 - corrosivity
 - acidic vapor corrosion 2:1326
 - aluminum alloys 3:2000

- aluminum/aluminum alloys 2:1326
 construction materials
 fire-retardant treatment chemicals 2:1328
 industrial significance 2:1327
 preservative treatments 2:1327
 contact corrosion
 acid content 2:1324, 2:1325*t*
 basic concepts 2:1324
 bimetallic corrosion 2:1325
 moisture content 2:1324
 polyphenolic compounds 2:1325
 salt content 2:1325
 staining 3:2444, 3:2445
 wood degradation effects 2:1325, 3:2442, 3:2445
 copper/copper alloys 2:1326
 corrosion test methods 2:1326
 general discussion 2:1323
 industrial significance
 background information 2:1327
 conservation efforts 2:1328
 construction materials 2:1327
 water cooling towers 2:1328, 3:2444
 water tanks 2:1328
 wood cutting tools 2:1328
 lead (Pb) 2:1326
 modeling methods 2:1327
 degradation conditions
 biological degradation
 marine borers 3:2445–2445
 wood-boring insects 3:2445
 wood-rotting fungi 3:2441, 3:2445
 corrosive liquids 3:2443
 marine environments 3:2442, 3:2445–2445
 mildly corrosive liquids 3:2444
 photooxidation 3:2441
 preservative treatments 3:2441
 staining 3:2444, 3:2445
 superficial degradation
 chemical damage 3:2445
 chemical stains 3:2445
 color change 3:2444
 nail sickness 3:2445
 weathered surfaces 3:2445
 lead corrosivity 3:2061
 physical properties 3:2439
 structure 2:1323
 wood-boring weevils 3:2445
 wood cutting tools 2:1328
 wooden vats 3:2443–2444
 woodworms 3:2445
 wools, glass 3:2307, 3:2308*t*, 3:2309*t*
 world fleet
 ballast tanks
 coating selection criteria 4:2692
 coating types and schemes 4:2694*t*
 interior photograph 4:2693*f*
 schematic diagram 4:2684*f*
 square meters of steel 4:2684*t*
 general discussion 4:2683
 ship characteristics 4:2684*f*
 ship types 4:2684*t*
 square meters of steel 4:2684*t*
 wrinkling 4:2735, 4:2741, 4:2744
 wüstite (FeO) 1:128, 1:201, 4:2487
- X**
- xenon (Xe) 2:1053*t*
Xestobium rufovillosum 3:2445
 X-rays
 basic concepts
 brilliance measurements 2:1388*f*
 cell geometries schematic diagram 2:1389*f*
 synchrotron radiation 2:1388, 2:1388*f*
 characteristics 2:1330
 corrosion studies
 electron microscopy
 basic concepts 2:1418
 line scan profile 2:1420*f*
 schematic diagram 2:1419*f*
 spectral data plot 2:1419*f*, 2:1420*f*
 energy dispersive X-ray (EDX) microscopy
 aluminum alloys 2:1406, 2:1406*f*, 2:1419–1420, 2:1419*f*, 2:1420*f*
 corrosion product characterizations 1:140
 Nimonic alloy–Stellite 6 alloy analyses 1:383, 1:384*f*, 1:385*f*, 1:386*f*,
 1:387*f*, 1:388*f*, 1:389*f*, 1:392*t*
 failure mechanisms 3:2465*f*
 general discussion 2:1403
 X-ray absorption (XAS)
 basic concepts 2:1395, 2:1395*f*
 characteristics 2:1376*t*
 extended X-ray absorption fine structure (EXAFS) 2:1397–1398,
 2:1398*f*
 near edge X-ray absorption fine structure (NEXAFS) spectroscopy
 2:1396–1397
 X-ray absorption near edge structure (XANES) 2:1396–1397, 2:1397*f*
 X-ray diffraction (XRD)
 basic concepts 2:1390, 2:1390*f*
 cementite analysis 1:286
 characteristics 2:1376*t*
 corrosion product characterizations 1:140, 1:143*f*
 passive film structure analysis 2:746, 2:1392*f*
 scattering geometry schematic diagram 2:1391*f*
 thermally induced scale changes 1:162–163, 1:163*f*
 X-ray microscopy 2:1425
 X-ray photoelectron spectroscopy (XPS)
 adhesive bond failure 3:2465, 3:2469, 3:2470*f*, 3:2471*f*, 3:2472*f*
 angular resolved XPS (ARXPS) measurements 2:1380–1382, 2:1381*f*
 atmospheric corrosion 3:2072
 Auger energy yield 2:1380*f*
 basic concepts 2:1378
 characteristics 2:1376*t*
 corrosion product characterizations 1:140
 energy diagram 2:1379*f*
 iron oxidation film evaluations 2:1380–1382, 2:1381*f*, 2:1382*f*
 passive film analysis 2:746, 2:1380–1382, 2:1381*f*, 2:1382*f*, 3:1923,
 3:1925*f*, 3:2244
 schematic diagram 2:1378*f*
 ultrahigh vacuum (UHV) conditions 2:1376, 2:1377*f*
 X-ray reflectivity (XRR)
 basic concepts 2:1393
 characteristics 2:1376*t*
 penetration depth plot 2:1393*f*
 specular X-ray reflectivity profiles 2:1394*f*
 X-ray tomography 2:1426, 2:1426*f*
 xylene 3:2380*t*
- Y**
- yacht Asgard 4:3313, 4:3313*f*
 yeast 4:2949, 4:2950
 Young–Dupré equation 3:2464
 Young's modulus 1:78, 1:80*f*
 yttrium (Y)
 alloying element influences 1:546, 1:546*f*
 alumina-forming alloys 1:546, 1:546*f*, 1:608*t*, 1:609*t*, 1:628, 1:628*f*, 1:630*f*
 chromia-forming alloys 1:423, 1:424*f*, 1:425*f*, 1:426*f*, 1:608*t*, 1:609*t*
 chromium–yttrium (Cr–Y) alloys 1:589
 coatings
 corrosion-resistant coatings 4:2618
 metal–chromium–aluminum–yttrium (MCrAlY) coatings
 aluminum depletion 1:709
 characteristics 1:696, 4:2550
 compositions 1:696*t*
 cracking 1:706, 1:707*f*, 1:708*f*
 estimated effective fracture energies 1:709*t*
 finite-element modeling predictions 1:708, 1:708*f*
 gas turbines 1:537*f*
 microstructure 1:697*f*
 protective oxidation 1:705, 1:706*f*
 spalling tendencies 1:706, 1:707*f*, 1:708*f*, 1:709*t*
 steam and steam/hydrogen environments 1:449, 1:450*f*, 1:451*f*, 1:452*f*

- yttrium (Y) (*continued*)
 structure 1:697f
 thermal barrier coatings 1:705, 1:705f, 1:712
 cobalt-based alloys 3:1918r
 cobalt–chromium–aluminum–yttrium (CoCrAlY) alloys 1:537f, 1:631
 cobalt–nickel–chromium–aluminum–yttrium (CoNiCrAlY) alloys 1:537f, 4:2552
 intermetallic alloys 1:655, 1:659
 magnesium alloys 3:2014–2015, 3:2016t, 3:2019r
 metal–matrix composites 3:2251
 Nd:YAG (neodymium-doped yttrium aluminum garnet) laser 3:2024, 4:2623
 nickel–chromium–aluminum–yttrium (NiCrAlY) alloys 1:615–616, 1:632f, 1:639
 nickel–cobalt–aluminum–yttrium (NiCoAlY) alloys 4:2624–2625
 oxidation processes 1:224
 silicon nitride (SiN) 3:2300
 tetragonal zirconia polycrystals (TZP) 3:2294, 3:2302f
 yttria-stabilized zirconia (YSZ)
 laser chemical vapor deposition (LCVD) 4:2630, 4:2630f
 laser cladding (LC) 4:2625
 thermal barrier coatings 1:705, 1:705f
 thermal expansion coefficients 1:484r
 yttrium-modified aluminides 4:2550f
 yttrium oxide (Y₂O₃) 1:145f, 1:170r
 Yucca Mountain, Nevada 2:767
- Z**
- zeolites 4:2973
 zero preservation problem 2:1558
 zero-resistance ammeter 4:2842f
 zinc (Zn) 3:2078–2093
 acid pickling 4:2992r
 adhesive bond failure 3:2479
 alloys 3:2078–2093
 aluminum–zinc–magnesium
 cast iron corrosion 3:1774
 copper–zinc (Cu–Zn) alloys 1:68f
 corrosion properties
 acid environments 3:2086
 alkaline environments 3:2086
 atmospheric corrosion 3:2081, 3:2082t, 3:2083f, 3:2083r
 bimetallic corrosion 3:2081
 cathodic protection 3:2089
 chemical environments 3:2086
 conductivity water 3:2084f
 corrosion rates 3:2081f
 corrosion reactions 3:2081r
 distilled water 3:2084t, 3:2085f
 galvanic corrosion 3:2080–2081
 general discussion 3:2080
 hard water 3:2084f
 intergranular corrosion 2:820, 3:2091
 natural waters 3:2083
 organic chemicals 3:2089
 pH effects 3:2081f, 3:2084–2085
 protective film formation 3:2080
 salt solutions 3:2089
 seawater 2:1142, 3:2085
 soil corrosion 3:2085, 3:2087r
 temperature effects 3:2085, 3:2085f, 3:2086f
 zinc–aluminum (Zn–Al) casting alloy corrosion 3:2090, 3:2091r
 electroplated coatings 4:2578
 intergranular corrosion 2:820, 3:2091
 magnesium (Mg) 3:2013
 mechanical properties 3:2079
 physical properties 3:2079
 pitting corrosion potential 2:782f
 recent research developments 3:2091
 sacrificial anodes 4:2767–2768, 4:2768r
 aluminum alloys 3:1981
 applications 3:2079
 archaeological metals 4:3313f
 atmospheric corrosion 2:848f, 2:1082
 brass dezincification 2:807, 2:807f, 3:1952
 cast iron corrosion 3:1774
 coatings
 active metal-rich pigmentation 4:2648
 characteristics 2:1165, 4:2524
 corrosion-resistant coatings 4:2618, 4:3184r
 diffusion coatings 4:2535r, 4:2536r
 electroplated coatings 4:2584, 4:2588t, 4:2589, 4:2589f
 failures and defects 4:2745
 flame sprayed coatings 4:2613
 hot-dipped coatings
 alloying additions 4:2569
 atmospheric corrosion 4:2558, 4:2559t, 4:2560r
 basic concepts 4:2556
 continuous zinc/zinc alloy coatings 4:2570
 corrosion behavior 4:2557, 4:2557f, 4:2558f
 detergents 4:2562
 inorganic chemicals 4:2562–2563
 lubricants 4:2563
 organic chemicals 4:2563
 soil corrosion 4:2562, 4:2563r
 steel 4:2563
 water corrosion 4:2562, 4:2562r
 white rust 4:2563–2564
 zinc–aluminum (Zn–Al) alloy coatings 4:2557f, 4:2558, 4:2558f
 zinc–iron (Zn–Fe) alloys 4:2558
 zinc carbonates 4:2745
 corrosion properties
 aqueous environments
 conductivity water 3:2084f
 distilled water 3:2084t, 3:2085f
 hard water 3:2084f
 natural waters 3:2083
 seawater 2:1142, 3:2085
 atmospheric corrosion
 environmental conditions 3:2081, 3:2083f
 United Kingdom 3:2082r
 urban/rural/marine atmospheres 3:2083r
 white rust 3:2083, 4:2563–2564, 4:2949
 bimetallic corrosion 3:2081
 cathodic protection 3:2089
 chemical environments
 acid environments 3:2086
 alkaline environments 3:2086
 organic chemicals 3:2089
 salt solutions 3:2089
 corrosion rates 3:2081f
 corrosion reactions 3:2081r
 galvanic corrosion 3:2080–2081
 general discussion 3:2080
 intergranular corrosion 2:820, 3:2091
 pH effects 3:2081f, 3:2084–2085
 protective film formation 3:2080
 soil corrosion 3:2085, 3:2087r
 temperature effects 3:2085, 3:2085f, 3:2086f
 zinc–aluminum (Zn–Al) casting alloy corrosion
 neutral salt spray 3:2091
 pH-controlled aerated water 3:2090
 wastewater treatment environments 3:2091, 3:2091r
 corrosion-resistant coatings 4:2995, 4:2995r
 corrosion vulnerability data 4:2956r
 corrosive environments 1:405
 crystal structure 1:55r
 fire-retardant treatment chemicals 2:1328
 fuel chemistry 1:459, 1:459r
 galvanic corrosion 2:831f, 2:850t, 2:851t, 2:852t, 2:1119f
 historical background 3:2078
 intergranular corrosion 2:820, 3:2091
 magnesium alloys 3:2013, 3:2016t, 3:2019r
 marine environments 2:1142
 mechanical properties 3:2079, 3:2080r
 nitric acid (HNO₃) solutions 2:1252r
 pH factors 2:1105
 physical properties 3:2079, 3:2080r
 pitting corrosion 2:774r
 potential–pH (Pourbaix) diagram 2:1083f, 2:1084f
 production processes 3:1862, 3:2079
 reactive metal pigments 4:2653

- recent research developments 3:2091
 redox couples equilibrium potential values 1:26r
 reference electrodes 2:1371t, 4:2848, 4:2849t
 sacrificial anodes 4:2771
 scale inhibitors/dispersants 4:2993t
 soil corrosion 2:1158, 2:1159f, 4:2562, 4:2563t
 standard reduction potential 3:2074t
 uniform corrosion 2:730
 white rust 3:2083, 4:2563–2564, 4:2949
 zinc–aluminum (Zn–Al) alloy coatings 4:2557f, 4:2558, 4:2558f
 zinc carbonate ($ZnCO_3$) 2:1088f, 4:2745, 4:2942t
 zinc chloride ($ZnCl_2$) 1:403f, 1:465f, 2:1089f, 3:1769t
 zinc chloride ($ZnCl_2$)–potassium chloride (KCl) mixtures
 chromium chloride ($CrCl_2$) solubility 1:328f
 iron chloride ($FeCl_2/FeCl_3$) solubility 1:328f
 nickel chloride ($NiCl_2$) solubility 1:329f
 waste incineration corrosion 1:328, 1:328f
 zinc–cobalt–iron (Zn–Co–Fe) coatings 4:3188t
 zinc–cobalt (Zn–Co) coatings 4:3188t
 zinc–iron (Zn–Fe) alloys 4:2558
 zinc–magnesium-containing alloys 3:1981
 zinc naphenate 2:1328
 zinc–nickel (Zn–Ni) coatings 4:3188t
 zinc oxide (ZnO) 1:114, 1:464t, 3:2197f, 3:2321t, 4:2670
 zinc phosphate ($ZnPO_4/Zn_3(PO_4)_2$) 4:2495, 4:2496t, 4:2497t, 4:2500t, 4:2670
 zinc silicate coatings 4:2695t, 4:2698t
 Zircaloy 3:2096, 3:2097t, 3:2099t, 3:2111
 zirconium (Zr) 3:2094–2134
 alloys
 alloy categories 3:2096
 alloying element influences 1:546, 1:546f
 alumina-forming alloys 1:546, 1:546f, 1:608t, 1:609t, 1:628
 amorphous alloys 3:2194
 anhydrous hydrogen halide gases/hydrohalic acids 2:1216f, 2:1221
 chemical properties 3:2100
 chromia-forming alloys 1:608t, 1:609t
 chromium–zirconium (Cr–Zr) alloys 1:589, 3:2198–2199, 3:2198f, 3:2199f, 3:2201
 cobalt-based alloys 3:1918t
 corrosion resistance 3:2100
 corrosive environments
 acetic acid 3:2125
 alkaline solutions 2:1204, 3:2124
 chlorinated organic compounds 3:2126
 chromic acid 3:2122
 cooling waters 3:2112
 formic acid 3:2125
 halogen acids 3:2116, 3:2130
 hydrogen peroxide (H_2O_2) 3:2124
 inorganic acids 3:2113
 mixed acids 3:2122, 3:2124t
 nitric acid (HNO_3) 3:2119, 3:2122f, 3:2124t, 3:2131
 organic acids 3:2125
 phosphoric acid (H_3PO_4) 3:2121, 3:2123f
 pressurized water and steam 3:2112
 salt solutions 3:2113, 3:2113t
 sulfur compounds 3:2113
 sulfuric acid (H_2SO_4) 3:2113, 3:2115f, 3:2116f, 3:2117f, 3:2118f, 3:2124t
 urea 3:2125
 corrosivity
 corrosion rates 3:2128t
 crevice corrosion 3:2106
 delayed hydride cracking 3:2109
 erosion 3:2110, 3:2111f
 fretting corrosion 3:2110
 galvanic corrosion 3:2109, 3:2110t
 intergranular corrosion 3:2107, 3:2108f
 localized corrosion 3:2106
 microbially-induced corrosion (MIC) 3:2110
 oxide films 3:2103
 pH effects 3:2105
 pitting corrosion 3:2106, 3:2107f
 potential–pH (Pourbaix) diagram 3:2105f
 stress corrosion cracking (SCC) 3:2108
 surface conditions 3:2111, 3:2111f
 temperature effects 3:2104, 3:2105f
 tin additions 3:2111
 water effects 3:2104
 Zircaloy 3:2096, 3:2097t, 3:2099t, 3:2111
 fatigue limits 3:2099t
 ferritic chromium steels 1:501t
 future developments 3:2132
 halogen acid corrosion
 anodic polarization curves 3:2120f, 3:2121f
 characteristics 3:2116
 corrosion rates 3:2124t, 3:2128t
 electrochemical protection 3:2129t
 fluoride-containing solutions 3:2119t
 hydrochloric acid (HCl) 3:2120f, 3:2121f
 industrial environments 3:2130
 isocorrosion diagram 3:2120f
 high-temperature environments
 high-temperature oxidation 3:2126
 hot corrosion 3:2126
 molten salts/molten metals 3:2127
 industrial applications
 general discussion 3:2130
 halogen acid-using processes 3:2130
 nitric acid-using processes 3:2131
 sulfuric acid-using processes 3:2130
 intergranular corrosion 2:820
 intermetallic alloys 1:655, 1:659
 internal corrosion risks 4:3217f
 magnesium alloys 3:2013, 3:2016t, 3:2019t
 manufacturing processes
 chemical cleaning 3:2103
 fabrication processes 3:2101
 handling concerns 3:2102
 heat treatments 3:2103
 welds 3:2103
 mechanical properties 3:2098t
 microstructure 3:2099, 3:2101f, 3:2102f
 nuclear and nonnuclear grades 3:2097t
 process equipment materials 4:3211
 protective treatments
 electrochemical protection 3:2128, 3:2128t, 3:2129t
 film formation 3:2127
 heat treatments 3:2128, 3:2129t
 pH adjustments 3:2128, 3:2129t
 surface conditions 3:2111f, 3:2128
 welds 3:2128, 3:2129t
 safety concerns 3:2132
 stress corrosion cracking (SCC) 2:867t
 stress–strain plots 3:2100f
 sulfuric acid (H_2SO_4) environments 2:1244, 2:1245f
 tensile properties–temperature curves plot 3:2100f
 Ti15Mo5Zr3Al alloy 2:1313
 zirconium–hafnium (Zr–Hf) alloys 3:2097t, 3:2098
 bulk metallic glasses 3:2199
 characteristics
 alloy categories 3:2096
 fatigue limits 3:2099t
 mechanical properties 3:2096, 3:2098t
 microstructure 3:2099, 3:2101f, 3:2102f
 nonnuclear wrought grades 3:2097t
 nuclear grades 3:2097t
 physical properties 3:2096, 3:2096t
 stress–strain plots 3:2100f
 tensile properties–temperature curves plot 3:2100f
 chemical properties 3:2100
 cobalt-based alloys 3:1918t
 corrosion resistance 2:1337, 3:2100
 corrosive environments
 aqueous environments
 cooling waters 3:2112
 salt solutions 3:2113, 3:2113t
 sulfur compounds 3:2113
 halogen acids
 anodic polarization curves 3:2120f, 3:2121f
 characteristics 3:2116
 corrosion rates 3:2124t, 3:2128t
 electrochemical protection 3:2129t

- zirconium (Zr) (*continued*)
- fluoride-containing solutions 3:2119*t*
 - hydrochloric acid (HCl) 3:2120*f*, 3:2121*f*
 - industrial environments 3:2130
 - isocorrosion diagram 3:2120*f*
 - inorganic acids
 - alkaline solutions 2:1204, 3:2124
 - chromic acid 3:2122
 - halogen acids 3:2116, 3:2130
 - hydrogen peroxide (H₂O₂) 3:2124
 - mixed acids 3:2122, 3:2124*t*
 - nitric acid (HNO₃) 3:2119, 3:2122*f*, 3:2124*t*, 3:2131
 - phosphoric acid (H₃PO₄) 3:2121, 3:2123*f*
 - sulfuric acid (H₂SO₄) 3:2113, 3:2115*f*, 3:2116*f*, 3:2117*f*, 3:2118*f*, 3:2124*t*
 - urea 3:2125
 - organic acids
 - acetic acid 3:2125
 - chlorinated organic compounds 3:2126
 - formic acid 3:2125
 - pressurized water and steam 3:2112
 - corrosivity
 - corrosion rates 3:2128*t*
 - erosion 3:2110, 3:2111*f*
 - fretting corrosion 3:2110
 - galvanic corrosion 3:2109, 3:2110*t*
 - localized corrosion
 - crevice corrosion 3:2106
 - delayed hydride cracking 3:2109
 - intergranular corrosion 3:2107, 3:2108*f*
 - pitting corrosion 3:2106, 3:2107*f*
 - stress corrosion cracking (SCC) 3:2108
 - microbially-induced corrosion (MIC) 3:2110
 - oxide films 3:2103
 - pH effects 3:2105
 - potential-pH (Pourbaix) diagram 3:2105*f*
 - surface conditions 3:2111, 3:2111*f*
 - temperature effects 3:2104, 3:2105*f*
 - tin additions 3:2111
 - water effects 3:2104
 - Zircaloy 3:2096, 3:2097*t*, 3:2099*t*, 3:2111
 - crystal structure 1:55*t*
 - fluoride corrosion 2:1264, 2:1265*t*
 - future developments 3:2132
 - general discussion 3:2095
 - high-temperature environments
 - high-temperature oxidation 3:2126
 - hot corrosion 3:2126
 - molten salts/molten metals 3:2127
 - industrial applications
 - general discussion 3:2130
 - halogen acid-using processes 3:2130
 - nitric acid-using processes 3:2131
 - sulfuric acid-using processes 3:2130
 - intergranular corrosion 2:820
 - ionizing radiation effects 2:1331
 - manufacturing processes
 - chemical cleaning 3:2103
 - fabrication processes 3:2101
 - handling concerns 3:2102
 - heat treatments 3:2103
 - welds 3:2103
 - nitric acid (HNO₃)
 - containment materials 2:1255
 - corrosion rates 2:1253*t*
 - corrosion reactions 2:1252
 - oxidation processes 1:224
 - pitting corrosion 2:774*t*
 - protective treatments
 - electrochemical protection 3:2128, 3:2128*t*, 3:2129*t*
 - film formation 3:2127
 - heat treatments 3:2128, 3:2129*t*
 - pH adjustments 3:2128, 3:2129*t*
 - surface conditions 3:2111*f*, 3:2128
 - welds 3:2128, 3:2129*t*
 - safety concerns 3:2132
 - solid oxide fuel cells (SOFCs) 1:510
 - stress corrosion cracking (SCC) 2:867*t*
 - surgical implants 2:1308
 - ultrahigh-temperature ceramics 1:680
 - zirconia (ZrO₂)
 - advanced technical ceramics 3:2295
 - amorphous alloys 3:2197*f*
 - corrosion behavior 1:674
 - enamel frit compositions 3:2321*t*
 - glass compositions 3:2308*t*
 - metal-matrix composites 3:2251
 - oxide films 3:2103
 - oxide scale growth 1:114
 - performance characteristics
 - material types 3:2294
 - stabilized zirconia 3:2294
 - tetragonal zirconia polycrystals (TZP) 3:2294, 3:2302*f*
 - transformation toughened partially stabilized materials 3:2294, 3:2295*f*
 - zirconium dioxide (ZrO₂) composites 3:2295
 - Pilling-Bedworth ratio (PBR) 1:146*t*, 1:160*t*
 - process equipment materials 4:3211*f*
 - yttria-stabilized zirconia (YSZ)
 - laser chemical vapor deposition (LCVD) 4:2630, 4:2630*f*
 - laser cladding (LC) 4:2625
 - thermal barrier coatings 1:705, 1:705*f*
 - thermal expansion coefficients 1:484*t*
 - zirconium beryllide (ZrBe₂) 3:2177, 3:2178*f*, 3:2179*f*
 - zirconium nitride (ZrN) 1:308*f*
 - zwitterions 3:2424, 3:2425*f*