

Index

A

Alloys (*see also* Hastelloy B-2; Super-alloys)
 Conductivity, electrical, 29-30
 Conductivity, thermal, 29-30
 KBI 40, 58, 59, 63, 65, 68
 Molybdenum, 4, 8, 9-16
 Nb-Ti, 76, 77, 78
 Nickel, 108
 Niobium, 50-69, 75, 76
 Ta-2.5W, 65
 Ta-Nb, 108
 Tantalum, 46, 50-69
 Titanium, 111
 Tungsten, 95, 96, 99, 102
 Aluminum
 Die casting tools, 10-11
 Electrolytics, 71, 72, 74
 Superconductivity, 77
 Ammonium paratungstate (APT) conversion, 84-85
 ANSI/ASME B31.3, 107
 Applications (*see also* under individual materials)
 Aerospace, 14, 18
 Chemical process industries, 106-114
 Electronic, 70-81
 High-temperature, 67
 Industrial, 18-27, 50-69
 Missile, 14
 Nuclear, 12-13, 15-16, 18
 Surgical, 167-168
 Aqueous environments, corrosion, 58-61
 ASME Boiler and Pressure Vessel Code, Section VII, 107

ASME Section X, 108

Automotive industry, alloys in, 10

B

BCS theory, 75
 Belz, L. H., 70-81
 Bismuth germanate, 79, 80
 "Black Fabrication," 11
 Burman, Russ, 3-17
 Burns, Robert H., 50-69

C

Cathodic protection, 66-67
 Chemical process industries
 Refractory metals in, 106-114
 Tantalum in, 28-49, 50, 64
 Copper, 77
 Corrosion resistance (*see also* under individual materials), 107, 109-111
 Of alloys, 35
 Corrosion-resistant materials
 Corrosive environments, 19-24, 39-40
 In aqueous environments, 58-61
 Industrial applications, 50-69
 CPI reaction vessels, 64

D

Density, tungsten, 88, 91, 102
 Ductility, 31, 86, 95, 102, 108

E

Electrical resistivity, tungsten, 88, 96
 Electrolytic capacitors, 70-75

- Electronic devices, tungsten in, 104
Electronics industry
 Niobium in, 70-81
 Tantalum in, 50, 70-81
Embrittlement, hydrogen, 109
 Niobium, 20, 23
 Prevention, 57
 Tantalum, 41, 44, 47, 58
- F**
- Fabrication methods, 62-63
 Molybdenum, 11, 113
 Niobium, 24-25
 Refractory metals, 61-63, 113
 Tantalum, 36, 47-49, 113
Failure, material, 57-58
Ferberite, 83
Fluoride and corrosion, 39-40, 110-111
- H**
- Hastelloy B-2, corrosion, 111
Heat exchangers, 64-65
Heat transfer equipment, 39
High temperature strength, 94, 104-105
Huebnerite, 83
Hunkeler, F. J., 28-49
- I**
- Inhomogeneities, 57-58
Isothermal forging process, 11
- L**
- Liquid metals handling, 67
Lithium niobate, 79, 80
Lithium tantalate, 79
- M**
- Manning, Paul E., 50-69
Melting point, tungsten, 88, 91, 104
- Molybdenum
 Alloys, 4, 8
 Mo-30W, 14-16
 TZM, 9-14
 And tantalum, 42
 Applications, 4-17
 Corrosion resistance, 4, 8, 109-111
 Cost, 108
 Fabrication, 11, 113
 Heat resistance, 4
 Metallic, 4-5
 Physical properties, 112
 Powder, 4
 Properties, 4-17
 Mullendore, James A., 82-105
- N**
- Nickel alloy, 108
Niobium
 Alloys, 50-69, 75, 76
 Anodic protection of, 56, 57
 Applications, 18-27, 64-67, 70-81
 Corrosion resistance, 18, 19, 24, 50-69, 109-111
 Cost, 24, 108
 Fabrication, 24-25
 Hydrogen embrittlement, 20, 23
 Limitations of, 56
 Mechanical properties, 19, 20
 Physical properties, 19, 112
 Superconductivity, 18, 75-78
 Surgical uses, 68
 Welding, 26, 27, 113
- O**
- Oxide films
 Amorphous, 51, 56, 72-73
 And corrosion, 51, 56
 Insulating, 71
 Niobium, 19, 20
 Tantalum, 34

P

- Piezoelectricity, 78-80
 Powder metallurgy techniques, 4, 5, 42, 86, 102, 103
 Pressure vessels, nonmetallic, 108
 Process equipment
 Corrosion considerations, 109-111
 Economic considerations, 108-109
 Material considerations, 106-108

Q

- Quartz crystals, 79, 80

R

- Reactive metals, corrosion resistance, 110
 Refractory metals
 Fabrication, 61-63, 113
 In chemical process industries, 106-114
 Physical properties, 111-113
 Reliability, 72, 107, 114
 Rhenium, 99, 104

S

- SAW filter, 79, 80, 81
 Scheelite, 83, 84
 Shuker, Fred S., Jr., 50-69
 Smallwood, Robert E., 1, 106-114, 115
 Steel
 Tantalum in, 42
 Tungsten in, 96
 Stress corrosion cracking
 And oxide films, 51, 56
 Tantalum, 46
 Superalloys, 12, 18
 Molybdenum, 4
 Niobium, 51
 Tungsten, 96
 Superconductivity, 18, 75-78

T

- Tantalum
 Alloys, 46, 50-69
 Anodic protection of, 56-57
 Applications, 28-49, 64-67, 70-81
 Chemical characteristics, 32-35
 Compatibility with other metals, 41, 42, 48
 Composites, 42
 Corrosion resistance, 31, 34, 35, 44, 45, 47, 50-69, 105-111
 Cost, 31-32, 33, 108
 Fabrication, 36, 47-49, 113
 In heat transfer equipment, 39
 Limitations of, 39-42, 56
 Machining, 49
 Performance characteristics, 44-47
 Physical properties, 28-32, 112
 Powder, 72, 75
 Reactivity, 28-29
 Reliability, 72
 Superconductivity, 75-78
 Surgical uses, 67-68
 Welding, 110, 113
 Workability, 47-48
 Telecommunications devices, 79
 Thermal conductivity, tungsten, 88, 93
 Thorium, 99
 Titanium, 12
 Alloys, 111
 And tantalum, 42
 Tungsten
 Alloys, 95, 96, 99, 102
 And tantalum, 42
 Applications, 95-105
 Carbide, 95
 Consolidation, 86
 Corrosion resistance, 110-111
 Ductility, 86, 95, 102
 Extraction of, 83-85
 Manufacture, 86-88
 Occurrence, 82-83

Properties, 88-95, 112

Reactivity, 98, 99

Reduction to powder, 85-86

Welding

Niobium, 26-27, 113

Tantalum, 42, 48

Wolframite, 83, 84

V

Vanadium gallium, 76, 78

Z

Zinc industry, 14-16

Zirconium

And tantalum, 42, 46

Corrosion resistance, 110, 111

W

Webster, R. T., 18-27