ASM Specialty Handbook®

Copper and Copper Alloys

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## Contents

### Preface ................................. vii

### Metallurgy, Alloys, and Applications ......................... 1

- Introduction and Overview .................................. 3
- Major Groups of Copper and Copper Alloys ................. 3
- Properties of Importance .................................. 3
- Fabrication Characteristics ................................. 5
- Alloy Terminology ......................................... 6
- Temper Terminology ........................................ 8

### The Copper Industry: Occurrence, Recovery, and Consumption ....... 10

- Production of Copper ..................................... 10
- Copper Fabricators ...................................... 13
- Markets and Applications ................................ 13

### Standard Designations for Wrought and Cast Copper and Copper Alloys ......... 14

- Alloy Designations ..................................... 14
- Temper Designations ................................... 14
- International Alloy and Temper Designations ............. 28

### Physical Metallurgy: Heat Treatment, Structure, and Properties ............. 31

- Commercially Pure Copper ................................ 31
- Copper-Zinc Alloys ..................................... 35
- Copper-Tin Alloys ...................................... 45
- Copper-Zinc-Tin Alloys ................................ 46
- Copper-Base Lead Alloys ................................ 46
- Copper-Aluminum Alloys ................................ 51
- Copper-Beryllium Alloys ................................ 52

### Wrought Copper and Copper Alloys ................................ 54

- Designating Copper and Its Alloys ......................... 54
- Wrought Copper and Copper Alloy Families .............. 54
- Strengthening Mechanisms for Wrought Copper Alloys .... 65
- Classification of Wrought Copper Products .............. 67
- Refinery Shapes ......................................... 67
- Wire Mill Products ....................................... 68
- Flat-Rolled Products .................................... 72
- The Manufacture of Sheet and Strip ....................... 74
- Tubular Products ........................................ 79
- Rod, Bar, and Shapes ................................... 82
- Forgings .................................................. 83

### Cast Copper and Copper Alloys ................................ 85

- Copper Casting Alloy Families ............................ 85
- Selection Criteria ....................................... 92
- Applications ............................................. 102

### Powder Metallurgy Copper and Copper Alloys .......................... 105

- The Powder Processing Route .............................. 105
- Pure Copper P/M Parts .................................. 106
- Bronze P/M Parts ....................................... 107
- Brass and Nickel Silver P/M Parts ....................... 110
- Copper-Nickel P/M Parts ................................ 111
- Copper-Lead P/M Parts .................................. 112
- Copper-Base Friction Materials ......................... 112
- Copper-Base Contact Materials .......................... 113
- Copper-Base Brush Materials ............................ 113
- Copper-Infiltrated Steels ................................ 114
- Copper-Base Dispersion-Strengthened Materials ....... 115

### Nonstructural Applications of Copper and Copper Alloy .................

- Powders ................................................. 118
- Shape Memory Alloys and Composite Materials .......... 121
- Shape Memory Alloys .................................... 121
- Tungsten-Copper P/M Composites ......................... 122
- Molybdenum-Copper P/M Composites ..................... 123
- Multifilament Composite Wires .......................... 123
- Copper-Clad Brazing Sheet ................................ 124

### Copper and Copper Alloy Coatings ................................ 127

- Copper Plating ........................................ 127
- Acid Plating Baths ..................................... 128
- Surface Preparation Considerations ...................... 129
- Bath Composition and Operating Variables ............. 130
- Plating in Dilute Cyanide Baths ......................... 131
- Plating in Rochelle Cyanide Baths ....................... 131
- Plating in High- Efficiency Sodium and Potassium Cyanide Baths ........................................ 132
- Plating in Noncyanide Copper Baths .................... 133
- Plating in Pyrophosphate Baths .......................... 133
- Plating in Acid Sulfate Baths ............................ 134
- Plating in Fluoborate Baths ............................. 134
- Wastewater Control and Treatment ....................... 135
- Copper Plating Equipment ................................ 135
- Characteristics of Copper Plate ........................ 135
- Copper in Multiplate Systems ............................ 136
- Cost ..................................................... 136
- Copper Alloy Plating ................................... 136
- Brass Plating ......................................... 137
- Bronze Plating ........................................ 139
- Waste Water Treatment .................................. 139
- Electroless Copper Plating ................................ 139
- Bath Chemistry and Reactions ............................ 139
- Deposit Properties ..................................... 140
- Applications .......................................... 142
- Pretreatment and Post-Treatment Processes ............. 144
- Controls ................................................ 147
- Performance Criteria ................................... 148
- Equipment .............................................. 148
- Environmental and Safety Issues ......................... 150

### Wear-Resistant and Corrosion-Resistant Copper Alloy Coatings ...........

- Wear-Resistant Coatings ................................ 150
- Corrosion-Resistant Coatings ............................ 150

### Applications ........................................ 153

- Building Construction ................................... 153
- Electrical Applications .................................. 156
- Electronic Equipment .................................... 159
- Industrial Machinery and Equipment ..................... 161
- Transportation ......................................... 165
- Consumer and General Products ......................... 167

### Fabrication and Finishing .................................. 169

- Melting and Casting ..................................... 171
Fabrication and Finishing (continued)

Casting Characteristics .......................... 171
Melting Practice .................................. 172
Fluxing of Copper Alloys ....................... 174
Degassing Copper Alloys ................. 176
Deoxidation of Copper Alloys ........ 181
Grain Refining of Copper Alloys .... 183
Filtration of Copper Alloys .............. 183
Melt Treatments for Group I to III Alloys . 183
Production of Copper Alloy Castings .... 184
Casting Process Selection ............... 186
Gating ............................................. 187
Feeding .............................................. 190

Forming ............................................. 195
General Considerations ..................... 195
Effects of Composition, Cold Work, and Heat
Treatment on Formability .................... 195
Formability of Copper Alloys versus Other Metals 197
Blanking and Piercing ......................... 198
Bending ......................................... 199
Drawing and Stretch-Forming ........ 201
Coining .......................................... 203
Spinning ......................................... 204
Contour Roll Forming ....................... 204
Rubber-Pad Forming ......................... 204
Specialized Forming Operations .... 205
Springback ...................................... 205
Forming Limit Analysis .................. 207
Bending of Rod, Bars, and Shapes ...... 208
Bending and Forming of Tubing .... 210
Rotary Swaging of Rod, Bars, and Tubes . 211
Forming of Wire ................................ 211
Forging and Extrusion ...................... 213
Hot Forging .................................. 213
Cold Extrusion ................................ 218
Cold Heading .................................. 219
Coining ........................................ 220
Hot Extrusion .................................. 221

Powder Metallurgy Processing .......... 222
Production of Copper Powder by the Reduction of
Copper Oxide .................................. 222
Production of Copper Powder by Electrolysis . 225
Production of Copper Powder by Atomization . 229
Production of Copper Powder by Hydrometallurgical
Processing .................................... 231
Production of Copper Alloy Powders .... 232
Powder Pressing ................................ 234
Sintering Principles ......................... 235
Sintering Practices for Bronze .......... 237
Sintering Practices for Brass and Nickel Silvers . 238

Heat Treating .................................... 242
Homogenizing .................................. 242
Annealing ....................................... 243
Stress Relieving ............................... 247
Hardening ....................................... 248
Heat-Treating Equipment ............... 249
Protective Atmospheres ................. 251
Heat Treating of Beryllium-Copper Alloys 253
Heat Treating of Chromium-Copper Alloys . 257
Heat Treating of Zincium-Copper Alloys 259
Heat Treating of Miscellaneous Precipitation-Hardening
Alloys ........................................ 259
Heat Treating of Spinodal-Hardening Alloys . 259
Heat Treating of Aluminum Bronzes .... 262

Machining ........................................ 264
Defining Machinability .................... 264
Machinability of Copper Alloys .......... 265

Type I (Free-Cutting) Alloys .............. 265
Type II (Short-Chip) Alloys .................. 267
Type III (Long-Chip) Alloys .................. 267
Additional Factors Affecting Machinability . 268
Selecting Copper Alloys for Machinability 268
Recommended Machining Practices .... 269
Nontraditional Machining Methods .... 274

Welding ........................................... 276
Arc Welding .................................... 276
Alloy Metallurgy and Weldability .... 276
Factors Affecting Weldability ........ 278
Arc Welding Processes .................. 278
Filler Metals ................................. 279
Welding of Coppers ......................... 281
Welding of High-Strength Beryllium Coppers . 284
Welding of High-Conductivity Beryllium Copper . 287
Welding of Cadmium and Chromium Coppers . 287
Welding of Copper-Zinc Alloys .... 288
Welding of Copper-Zinc-Nickel Alloys . 288
Welding of Phosphor Bronzes ........ 288
Welding of Aluminum Bronzes ...... 289
Welding of Silicon Bronzes ............. 291
Welding of Copper-Nickel Alloys ... 292
Welding of Dissimilar Metals ........ 293
Safe Welding Practices ................. 294

Other Non-Arc Fusion Welding Processes . 295
Oxyfuel Gas Welding ...................... 295
Resistance Welding ....................... 296
Electron Beam and Laser Beam Welding ... 299
Solid-State Welding ...................... 299
Brazing, Soldering, and Adhesive Bonding . 303
Brazing ......................................... 303
Soldering ...................................... 313
Adhesive Bonding ......................... 318
Surface Engineering ...................... 320
Cleaning and Finishing Processes .... 320
Preparation for Plating .................. 326
Plating, Coating, and Coloring Processes . 328

Metallography, Microstructures, and Phase Diagrams .......... 335
Metallography and Microstructures of Copper and Copper Alloys . 337
Macroexamination .......................... 337
Microexamination ......................... 337
Metallography and Microstructures of Beryllium-Copper Alloys . 354
Health and Safety ......................... 354
Specimen Preparation .................. 354
Macroexamination ....................... 355
Microexamination ....................... 355
Microstructures of Beryllium-Copper Alloys . 356
Solidification Structures of Copper Alloy Ingots ........ 360
Dendrites .................................. 360
Grains ........................................ 363
Ingot Defects ............................. 365
Phase Diagrams .............................. 369

Engineering Properties and Service Characteristics ........ 383
Corrosion Behavior ....................... 385
Nature of the Protective Oxide Film .... 385
Effects of Alloy Compositions .......... 385
Type of Attack .............................. 387
Factors Influencing Alloy Selection in
Specific Environments ..................... 392
Atmospheric Corrosion .................. 395
Corrosion in Soils and Groundwater .... 397
Corrosion in Waters ...................... 398
Corrosion in Acids ....................... 404
Corrosion in Alkalis .................... 407
Engineering Properties and Service Characteristics (continued)

C71500 70Cu-30Ni ........................................ 523
C71900 67Cu-30Ni-2.8Cr .................................. 524
C72200 83Cu-16.5Ni-0.5Cr ................................. 524
C72500 88.2Cu-9.5Ni-2.3Zn ............................... 525
C74500 65Cu-25Zn-10Ni ................................. 525
C75200 65Cu-18Ni-17Zn ................................. 526
C75400 65Cu-20Zn-15Ni ................................. 526
C75700 65Cu-23Zn-12Ni ................................. 527
C77000 55Cu-27Zn-18Ni ................................. 527
C78200 65Cu-25Zn-8Ni-2Pb ............................ 528

Properties of Cast Copper Alloys .......................... 529
C81100 .................................................. 529
C81300 .................................................. 529
C81400 99Cu-0.8Cr-0.06Be ................................ 529
C81500 99Cu-1Cr .......................................... 530
C81800 97Cu-1.5Co-1Ag-0.4Be ............................ 530
C82000 97Cu-2.5Co-0.3Be ................................ 531
C82200 98Cu-1.5Ni-0.5Be ................................ 532
C82400 98Cu-1.7Be-0.3Co ................................ 532
C82500 97.2Cu-2Be-0.5Co-0.25Si ......................... 533
C82600 97Cu-2.4Be-0.5Co ................................ 535
C82800 96.6Cu-2.6Be-0.5Co-0.3Si ......................... 535
C83300 .................................................. 536
C83600 85Cu-55Sn-5Pb-5Zn ................................ 536
C83800 83Cu-45Sn-6Pb-7Zn ................................ 537
C84400 81Cu-35Sn-7Pb-9Zn ................................ 538
C84800 76Cu-21Sn-62Pb-15Zn ............................ 538
C85200 72Cu-15Sn-24Zn ................................. 539
C85400 67Cu-13Sn-29Zn ................................. 539
C85700, C85800 63Cu-15Sn-1Pb-35Zn ..................... 539
C86100, C86200 64Cu-24Zn-3Fe-5Al-4Mn ............... 540
C86300 64Cu-26Zn-3Fe-3Al-4Mn ......................... 540
C86400 59Cu-0.75Sn-0.75Pb-37Zn-1.25Fe-0.75Al-0.5Mn . 540
C86500 58Cu-39Zn-1.3Fe-1Al-0.5Mn ..................... 541
C86700 .................................................. 542
C86800 .................................................. 543
C87300 (formerly C87200) ................................ 543
C87600 .................................................. 544
C87610, Silicon Bronze ................................... 545
C87500, C87800 82Cu-4Si-14Zn ......................... 545
C87900 .................................................. 545
C90300 88Cu-8Sn-4Zn .................................... 546
C90500 88Cu-10Sn-2Zn ................................... 546

Appendix .................................................. 565
Specification Cross-Reference for Wrought and Cast Products ........ 567
Approximate Equivalent Hardness Numbers for Wrought Coppers ..... 588
Approximate Equivalent Hardness Numbers for Cartridge Brass ..... 589
Subject Index ........................................... 591
Alloy Index ............................................... 621
Preface

Copper is mankind’s oldest metal, dating back some 10,000 years. All of the great civilizations of the past, including the Sumerian, Egyptian, Greek, Roman, and Chinese, used copper and copper alloys (principally bronze and later brass) for both decorative and utilitarian purposes. From antiquity through the Middle Ages and the Renaissance, copper was used for military purposes, artistic applications such as church bells and statuary, tools, and numerous other functional objects. However, it was the Industrial Revolution that brought about a tremendous change in the production and consumption of copper and copper alloys. Electrical engineering in the modern industrial sense followed from Michael Faraday’s discovery of electromagnetic induction in 1831, Werner von Siemens’ invention of the electric dynamo in 1866, and Thomas Edison’s invention of the electric light bulb in 1878 and his construction of the first electrical power generating plant in 1882. To this day, copper remains the key to modern power generation.

The industrial importance of copper in the 20th and 21st centuries has been extended by the ease with which it combines with other metals. Tin and zinc are and always have been the principal alloying elements, but many others—aluminum, nickel, beryllium, chromium, cadmium, manganese, etc.—form alloys with unique combinations of mechanical and physical properties and excellent corrosion and wear resistance. These attributes have contributed toward copper and its alloys being the material of choice for building construction (e.g., plumbing, wiring, and roofing), but have also led to the use of copper in many demanding engineering applications in the marine, automotive, chemical, and electronics industries. Continuing developments in superconductors, electric vehicles, solar heating, and large-scale desalination of water should ensure that copper remains an essential material in the future.

Recognizing the industrial importance of this metal, ASM International has devoted the eighth volume of the ASM Specialty Handbook series to the engineering aspects of copper and copper alloys. Divided into four major sections, this book describes the metallurgy and applications of wrought, cast, and powder metallurgy alloys; fabrication and finishing procedures; metallography, microstructures, and phase diagrams; and engineering properties and service characteristics. Although several excellent texts have been published on copper during the past 25 years, none can match the breadth of coverage offered in this Handbook.

The sustained growth and development of the copper industry can be attributed in large part to the following technical organizations: the Copper Development Association Inc. (CDA), the International Copper Association, Ltd. (ICA), and the Canadian Copper & Brass Development Association (CCBDA). ASM International wishes to express its thanks for the cooperation it received from these organizations during the course of this project. The editor also extends his appreciation to these organizations as well as the hard working and cooperative ASM Editorial and Library staffs. Lastly, the contributions of the many authors who have written articles on copper and copper alloys published in the ASM Handbook should also be recognized. Their respective works are acknowledged throughout this Handbook.

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