# Volume 4 Heat Treating

#### 1. Heat Treating of Steel

Surface Hardening of Steel

**Heat-Treating Equipment** 

**Process and Quality Control Considerations** 

Heat Treating of Cast Irons

Heat Treating of Tool Steels

Heat Treating of Stainless Steels and Heat-Resistant Alloys

Heat Treating of Nonferrous Alloys

**Supplementary Information** 

## 2. Surface Hardening of Steel

Introduction to Surface Hardening of Steels

Flame Hardening of Steels

Laser Surface Hardening

Electron Beam Surface Hardening of Steels

Gas Carburizing of Steels

Pack Carburizing of Steels

Liquid Carburizing and Cyaniding of Steels

Vacuum Carburizing of Steels

Plasma (Ion) Carburizing of Steels

Microstructures and Properties of Carburized Steels

Carbonitriding of Steels

Gas Nitriding of Steels

Liquid Nitriding of Steels

Plasma (Ion) Nitriding of Steels

Gaseous and Plasma Nitrocarburizing of Steels

Boriding (Boronizing) of Steels

Thermoreactive Deposition/Diffusion Process for Surface Hardening of Steels

Methods of Measuring Case Depth in Steels

# 3. Heat-Treating Equipment

Types of Heat-Treating Furnaces

Salt Bath Heat-Treating Equipment

Fluidized-Bed Heat-Treating Equipment

Heat Treating in Vacuum Furnaces and Auxiliary Equipment

Heat-Resistant Materials for Heat-Treating Furnace Parts, Trays, and

**Fixtures** 

Energy-Efficient Heat-Treating Furnace Design and Operation

## 4. Process and Quality Control Considerations

Temperature Control in Heat Treating

Furnace Atmospheres for Heat Treating

Furnace Atmosphere Control in Heat Treating

Control of Surface Carbon Content in Heat Treating of

Steel

**Evaluation of Carbon Control in Processed Parts** 

Defects and Distortion in Heat-Treated Parts

Statistical Process Control of Heat-Treating Operations

Computerized Properties Prediction and Technology

Planning in Heat Treatment of Steels

Furnace Safety in Heat Treating

## **5. Heat Treating of Cast Irons**

Introduction to Heat Treating of Cast Irons

Heat Treating of Gray Irons

**Heat Treating of Ductile Irons** 

Heat Treating of Malleable Irons

Heat Treating of High-Alloy Irons

#### 6. Heat Treating of Tool Steels

Introduction to Heat Treating of Tool Steels

Processes and Furnace Equipment for Heat Treating of

**Tool Steels** 

Heat Treating of Specific Classes of Tool Steels

Control of Distortion in Tool Steels

## 7. Heat Treating of Stainless Steels and Heat-Resistant Alloys

Heat Treating of Stainless Steels

Heat Treating of Super alloys

Heat Treating of Refractory Metals and Alloys

# 8. Heat Treating of Nonferrous Alloys

Principles of Heat Treating of Nonferrous Alloys

Heat Treating of Aluminum Alloys

Heat Treating of Copper Alloys

Heat Treating of Magnesium Alloys

Heat Treating of Nickel and Nickel Alloys

Heat Treating of Titanium and Titanium Alloys

Heat Treating of Tin-Rich Alloys

Heat Treating of Lead and Lead Alloys Heat Treating of Uranium and Uranium Alloys Annealing of Precious Metals

# 9. Supplementary Information

Temper Colors for Steels
Austenitizing Temperatures for Steels
Glossary of Terms
Abbreviations, Symbols, and Trade names