SEMINARS FOR ENGINEERS

Fundamentals of Heat Treating and Plating Fasteners and Other Small Components

About the Seminar:

This two-day seminar was developed for engineers and technical personnel to gain a high level, broad understanding of why and how fasteners and other similar items are heat treated and plated or coated. The demands on today's fasteners are ever increasing and these two process steps play a critical role in how well the fastener will perform its intended function.

This seminar will begin by exploring the fundamental metallurgical transformations and principals that yield the mechanical changes desired by the fastener designer or engineer. Each process will be examined in greater detail to understand how the process achieves these underlying principals and what practical effects it has on the fastener. Control points will be investigated to gain an understanding of, not only how the process remains in control, but also how it can go wrong and the consequences when it does.

Day two will explore platings and coatings. There are a multitude of good options today and this seminar shall look at those favored by large fastener consuming industries. In addition to gaining an understanding of the plating or coating system, this seminar shall explore the application processes, significant control points, how they impact fastener performance and common pitfalls and errors. Unlike most of the processes utilized in manufacturing fasteners which have changed little in recent years, this seminar shall explore how the plating and coating processes and options are evolving rapidly to address ever increasing demands for performance and friendliness to the environment.

Who Should Attend:

Fasteners are used extensively in every industry. Since the mechanical performance and physical characteristics are, in fact, critical in many instances, this seminar is very beneficial to professionals that are working on design, development, application engineering, fastener procurement, and quality assurance. If you are involved in the fastener supply chain or are an end user and seek to gain a better understanding of the fundamentals of heat treating and plating of fasteners, this course is designed especially for you.

Benefits of Attending

- Gain an understanding of what is occurring when a fastener is heat treated
- Become familiar with the common heat treating processes for fasteners
- Understand when to specify specific processes or equipment Recognize potential failures modes
- Gain an understanding of the benefits of different platings and coating
- Understand when to specify certain plating or coating processes
- Gain insight into plating and coating performance and relative cost to achieve these goals
- Explore current issues in regulation and environmental protection

Concepts Covered

- Metallurgical transitions
- Hardenability
- Quench and Temper
- Austempering
- Case Hardening
- Annealing
- Induction Hardening
- Furnace Types
- Furnace Atmosphere
- Quenching
- Tempering
- Heat Treating Control Points
- Heat Treating Potential Failure Modes
- Electroplating
- Barrier Coatings
- Crystalline and Oxide Finishes
- Mechanical Plating
- Dip Spin Finishes
- Plating Potential Failure Modes

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Course Syllabus - Day 1

Basic Metallurgical Principals
- The unit cell and crystal structure
- Allotropy
- Effect of alloying elements
- Phase Transformation
- Equilibrium structures in steel
- Iron-Carbon Phase Diagram
- Pearlite, Bainite, and Martensite

Steels
- Classification of steels
- Alloying elements
- Hardenability
- TTT Diagram
- Stainless Steels
- Tool Steels

Considerations in Fastener Design
- Strength
- Toughness
- Ductility
- Aspect ratio
- Nut strength relative to bolt strength
- Tapping screws

Material Standards
- Most common
- Understanding and interpreting
- Material Composition
- Test requirements

Hardening Processes
- Quench and Temper
- Marquenching
- Austempering
- Induction Hardening

Surface Hardening
- Carburizing
- Carbonitriding (Case Hardening)
- Nitriding
- Ferritic Nitrocarburizing

Annealing and Stress Relief
- Annealing
- Normalizing
- Stress Relief

Heat Treating Process Elements
- Furnace Atmosphere
- Quenching
- Tempering
- Racking and loading

Heat Treating Equipment
- Continuous Belt Furnace
- Atmospheric Batch Furnace
- Vacuum Furnace
- Induction
- Other

Potential Failure Modes
- Quench Cracking
- Oxidation
- Distortion
- Decarburization
- Carburization
- Untempered Martensite
- Retained Austenite
- Intergranular Oxidation
- Temper Embrittlement

Heat Treater Control Practices

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Course Syllabus - Day 2

Design Criteria
- Corrosion resistance
- Appearance
- Function/Performance

Electroplating
- Common Applications
- Fundamental chemistry behind electroplating
- Pros and cons
- Commercial Plating Operations

Mechanical Plating
- Common Applications
- How the process works
- Pros and cons

Crystalline and Oxide Finishes
- Phosphate Treatments
- Black Oxide
- Annodization
- Passivation

Dip Spin and Barrier Coatings
- Zinc and Al rich dip spin
- E-coat
- Hot Dip Galvanizing

Other
- Ceramic coatings
- Chrome
- Electroless Nickel
- IVD Aluminum
- Powder Coating

Plating and Coating Standards
- Most common
- Understanding and interpreting
- Test requirements

Corrosion
- Types of corrosion
- Mechanisms
- Relative performance of platings and coatings

Corrosion Testing
- Salt Spray
- Cyclic Methods
- Other Methods
- Addressing Failures

Potential Failure Modes
- Recess Fill
- Build-up in threads
- Adhesion
- Color/Appearance issues

Hydrogen Embrittlement
- What is it
- 3- triggering factors
- Prevention

Current Affairs
- Hexavalent chromium
- Cadmium
- REACH
- RoHs