Metallurgy Training Courses & Topics

Metallurgy Training Topics

The following is a summary of potential training topics that can be delivered to suit your company's or organization's specific requirements. Customization may include unique materials or conditions, particular problems, or other topics the client provides.

Course 1: Principals of Metallurgy (4hrs)

Our most popular metallurgy course, teaching you the fundamental metallurgy concepts that apply to all metals and explains how these concepts apply to approaches for modifying metal strength and harness.

Course Content

- *Introduction*
- *Composition*
- *Microscopic structures*
- *Crystal defects*
- *Diffusion*
- *Application of Metallurgy Principles*
- *Cold working*
- *Annealing cold-worked metals*
- *Solid solution strengthening*
- *Steel Metallurgy*
- *Precipitation Strengthening*

Learning Objectives

- *Relationship between a metal's properties and its composition, microscopic structure, and the manufacturing processes used to fabricate the metal.*
- *Microscopic structures in metals.*
- *How microscopic structures and metal composition influence metal strength.*
- *How microstructure changes occur during heat treating.*
- *Metallurgical changes due to alloying, cold working, and heat treating, and their effects on metal strength*

Course 2: Steel Metallurgy (3hrs)

This course teaches the fundamentals of steel metallurgy related to the effects of carbon content and various heat treatments on steel microstructure and how they affect the hardness, strength, and toughness of the material.

Course Content

- *Introduction*
- *Steel types and designations*
- *Steel phases*
- *Iron-carbon phase diagram*
- *Steel Heat Treating Introduction*
- *Hot rolling, Annealing, and Normalizing*
- *Through Hardening*

Learning Objectives

- *Steel types & designations used for the different categories of steel alloys.*
- *Metallurgical phases and microstructures found in steels and their effects on steel strength and hardness.*
- *How to use the iron-carbon phase diagram to predict the phases present in a steel alloy based on composition and temperature.*

- *Microstructure changes that occur in steel during heating and cooling and the resulting effects on strength and hardness*
- *Effects of cooling rate on the microstructure that forms when steel is quenched during through hardening heat treatment.*

Course 3: Aluminum Metallurgy (2hrs)

There are a wide variety of wrought aluminum alloys, each developed to provide specific properties. Getting the strength you need in an aluminum alloy requires knowledge of the effects of alloy composition, cold-working, and heat treating on aluminum metallurgy and properties.

Course Content

- *Introduction*
- *Alloy and Temper Designations*
- *Solid Solution and Dispersion Strengthening*
- *Cold Worked Tempers*
- *Precipitation Strengthening*

Learning Objectives

- *The different families of wrought aluminum alloys*
- *Composition and strength differences between the alloy families.*
- *Relationship between metal strength and the microscopic structures that influence strength.*
- *Effects of cold-working, alloying, and heat treating on aluminum microstructure and strength.*
- *Aluminum temper designations for cold-worked and precipitation strengthened alloys.*

Course 4: Metal Failure Analysis (5hrs)

Learn about the metallurgical evaluations used for a metal failure analysis and how to perform failure analysis of fractures, corrosion failures, and manufacturing quality problems.

Course Content

- *Failure and Root Cause Analysis*
- *Failure Analysis Process*
- *Analysis Techniques Introduction*
- *Visual and Stereo Zoom Examination*
- *Non-destructive Testing*
- *Scanning Electron Microscopy*
- *Metallography*
- *Composition Analysis*
- *Mechanical Testing*
- *Fracture Failure Analysis*
- *Fracture Case Studies*
- *Corrosion Failure Analysis*
- *Corrosion Case Studies*
- *Manufacturing Failure Analysis Steps and Case Studies*

Learning Objectives

- *The common metal failure analysis techniques used to analyze metals and the data obtained from the analyses.*
- *How to determine failure mode and mechanism.*
- *How to select, collect, handle, and prepare samples for failure analysis.*
- *The background information required to determine failure mechanism and root cause.*

- *The common techniques used for failure analysis and the data obtained.*
- *How to determine fracture mode based on the appearance of a fracture surface.*
- *How to perform a failure analysis on fracture, corrosion, and manufacturing failures.*

Course 5: Steel Case Hardening (2hrs)

With the knowledge from this class you will be better able to select the most appropriate alloy and heat treating process, evaluate suppliers, develop manufacturing processes, and solve quality problems..

Course Content

- *Carburizing, carbonitriding, nitriding, nitrocarburizing*
- *Flame hardening and induction hardening*

Learning Objectives

- *Process conditions for carburizing, nitriding, carbonitriding, nitrocarburizing, flame hardening, and induction hardening.*
- *Microstructure and property changes that occur during case hardening heat treating processes.*
- *Measuring case depth.*
- *Composition and microstructure requirements of steel for case hardening.*

Course 6: Electroplating (3hrs)

With this class you'll gain knowledge about the electroplating process steps, important coating properties and features and how they are evaluated, and coating defects and causes is important for getting coatings that meet your specifications.

Course Content

- *Process steps*
- *Coating properties, features, and defects*
- *Coating Uses*
- *Coating selection, coating specification, supplier evaluation*

Learning Objectives

- *Process steps for electroplating and supporting processes*
- *Different process formats*
- *Coating properties, features, and defects, and how they are evaluated*
- *Effects of electroplating process steps on coating properties, features, and defects*
- *Important coating properties, features, and defects for six different coating uses.*
- *Selecting and specifying coatings*
- *Evaluating electroplating companies*