



**MUE153**

# **Materials Failure Analysis & Prevention**

## Course Introduction:

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This course is for plant and reliability engineers, maintenance engineers, mechanical engineers, inspectors and managers who wish to increase their knowledge on the key aspects of designing and maintaining fixed equipment.

This course is intended for plant engineers in design, maintenance, reliability and inspection; project engineers involved with the purchase of new equipment; plant inspectors responsible for fixed equipment; maintenance staff interested in expanding their understanding of metallurgy; as well as associated individuals in central engineering functions.

## Course Objectives:

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**Upon successful completion of this course, the delegates will be able to:**

- ✓ Distinguish between materials such as austenitic, ferritic and martensitic stainless steels; locate, use and understand key information from typical industry standards;
- ✓ Determine how the mechanical properties of some materials will be influenced by heat treatment;
- ✓ Recognize some related issues such as failure analysis and material selection

## Who Should Attend?

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This course is especially valuable for recent graduate engineers and new inspectors, mechanical engineers, maintenance engineers and anyone who wish to gain more knowledge.

## Course Outline:

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### Day 1:

#### **Materials and Properties**

##### A. Construction Materials

- Carbon Steel
- Low Alloy Steel
- Stainless Steels
- Ni Alloys
- Cu Alloys
- Ti Alloys
- Aluminum Alloys

##### B. Mechanical Properties

- Tensile

- Impact
- Hardness
- Fatigue
- C. Physical Properties
  - Thermal Expansion
  - Thermal Conductivity
  - Electrical Conductivity / Resistivity

### **Steel Making**

- A. Melting Processes
- B. Role of Alloying Elements
- C. Grain Size and De-oxidation Relationship to Toughness

### **Day 2:**

#### **Crystal Structure and Heat Treatment**

- A. Crystal Structure
- B. Iron Carbon Diagram
- C. Continuous Cooling Diagrams
- D. Time-Temperature-Transformation Diagrams
- E. Annealing, Normalizing, Quenching, Tempering, PWHT

#### **Material Specifications/Identification**

- A. ASTM /ASME
- B. SAE / AISI
- C. Unified Numbering System

### **Day 3:**

#### **Castings**

- A. General
- B. Cast Irons - Gray, Ductile, Malleable
- C. Austenitic SS Castings - ACI Castings Corrosion and Heat Resisting

### **Day 4:**

#### **Miscellaneous Materials Issues**

- A. Failure Analysis
- B. Material Selection

### **Day 5:**

- Failure Analysis
- Bolted Flange Connections
- Mechanical Repairs
- Vibration Failures (Fixed Equipment)
- Material Properties
- Inspection and Testing (RBI & Inspection Methods)
- Principles of Corrosion (Case Studies)
- Cracking
- Welding & Welding Repair
- Mechanical Joints and Repairs
- Various Failure Mechanisms
- Failure Analysis

## **Course Certificate:**

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**International Center for Training & Development (ICTD)** will award an internationally recognized certificate(s) for each delegate on completion of training.

## **Course Methodology:**

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**A variety of methodologies will be used during the course that includes:**

- (30%) Based on Case Studies
- (30%) Techniques
- (30%) Role Play
- (10%) Concepts
- Pre-test and Post-test
- Variety of Learning Methods
- Lectures
- Case Studies and Self Questionnaires
- Group Work
- Discussion
- Presentation

## Course Fees:

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**To be advised as per the course location.** This rate includes participant's manual, and-Outs, buffet lunch, coffee/tea on arrival, morning & afternoon of each day.

## Course Timings:

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### Daily Course Timings:

08:00 - 08:20	Morning Coffee/Tea
08:20 - 10:00	First Session
10:00 - 10:20	Recess (Coffee/Tea/Snacks)
10:20 - 12:20	Second Session
12:20 - 13:30	Recess (Coffee/Tea/Snacks)
13:30 - 15:00	Last Session

