MATERIAL FAILURE ANALYSIS, EVALUATION AND PREVENTION

COURSE OVERVIEW

The course provides a comprehensive understanding of material failure analysis, equipping participants with the knowledge and practical skills to identify, analyze, and prevent common failure mechanisms in engineering materials. You'll learn standardized procedures for failure investigation, differentiate between various fracture types (ductile, brittle, fatigue, wear), and understand failures influenced by corrosion, environmental factors, and elevated temperatures. The course emphasizes applying root cause analysis techniques to develop effective solutions and prevent future recurrences, ensuring enhanced product reliability and safety.

DATES, VENUES AND FEES

14 – 18 December 2025 - Doha
(5 Days)

Fees US$ 4500

Note: Fee is per participant.
Groups from the same company can enjoy a **discounted** price.

WHO SHOULD ATTEND?

This course is appropriate for a wide range of professionals but not limited to:

- Materials Engineers
- Mechanical Engineers
- Metallurgists
- Design Engineers
- Reliability Engineers
- Maintenance and Operations Personnel
- Quality Control/Assurance Professionals

CONTACT US NOW

+971 (4) 4539841 – 42 – 43
WhatsApp: +971 52 398 7781

Millennium Solutions Training Center FZ-LLC
First Floor, Office #134, Knowledge Park, Block 2B, Dubai, UAE
Email: info@mstcme.com
Website: www.mstcme.com

ACCREDITATION

This training course is certified by CPD.

The CPD Certification Service is the leading independent CPD accreditation institution operating across industry sectors to complement the Continuing Professional Development policies of professional institutes and academic bodies. The CPD Certification Service provides support, advice, and recognised independent CPD accreditation compatible with global CPD principles. CPD is the term used to describe the learning activities professionals engage in to develop and enhance their abilities and keep skills and knowledge up to date. CPD Units are only awarded to programmes after each programme is scrutinised to ensure integrity and quality according to CPD standards and benchmarks.

COURSE CERTIFICATE

MSTC certificate will be issued to all attendees completing a minimum of 80% of the total tuition hours of the course.

CPD internationally recognized certificate will be issued for all participants who will meet the course requirements.
CPD certificates will be issued within a month of the successful completion of the course.

TRAINING METHODOLOGY

- Expert instructor lecture, input using numerous visual aids
- Supportive comprehensive course manual enabling practical application and reinforcement
- Participant discussion and involvement regarding their specific projects and challenges
- Real-world case studies and best practices

LEARNING OBJECTIVES

By the end of this course, participants should be able to:

- Establish the purpose, scope, and standardized approach to material failure analysis
- Learn how to identify, analyze, and differentiate fracture types in materials
- Understand failure mechanisms caused by repeated loading and surface degradation
- Analyze failures influenced by environmental and thermal exposure
- Apply failure analysis skills in real-world contexts to develop solutions and prevent recurrence

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COURSE OUTLINE

DAY 1

Introduction & General Procedures for Failure Analysis

- Pre-test
- Importance of Failure Analysis in Engineering and Safety
- Types of Failures: Ductile, Brittle, Fatigue, Wear, Corrosion, Creep
- Types of Stress: Tensile, Compressive, Shear, Residual, Thermal, Cyclic
- Stress-Strain Behavior and Material Deformation
- General Procedures for Failure Analysis:
  - Problem Definition and Background Review
  - Visual and Macroscopic Examination
  - Sample Preservation and Documentation
  - Initial Hypothesis Formation
- Group Exercise

DAY 2

Ductile and Brittle Fractures

- Ductile Fracture:
  - Characteristics (e.g., necking, dimple formation)
  - Energy absorption and plastic deformation
- Brittle Fracture:
  - Cleavage, Intergranular Fracture
  - Fracture toughness and critical flaw size
- Fractography Basics:
  - Visual and SEM-based Fracture Surface Analysis
  - Fracture Patterns and Origin Determination
- Case Study

DAY 3

Fatigue and Wear Failures

- Fatigue Failures:
  - High-cycle vs. Low-cycle Fatigue
  - Crack Initiation and Growth
  - Beach Marks and Striations
  - Design and Operational Factors in Fatigue
- Wear Failures:
  - Types: Adhesive, Abrasive, Fretting, Erosive
  - Wear Particle Analysis
  - Surface Treatments and Lubrication
- Case Study

DAY 4

Corrosion and Elevated-Temperature Failures

- Corrosion Failures:
  - Uniform, Galvanic, Pitting, Crevice, Intergranular, SCC
  - Mechanisms, Detection, and Prevention
- Elevated-Temperature Failures:
  - Creep Deformation: Primary, Secondary, Tertiary Stages
  - Thermal Fatigue
  - Microstructural Changes at High Temperatures
- Combined Effects: Thermal and Corrosive Environments
- Case Study

DAY 5

Failure Prevention and Root Cause Analysis

- Root Cause Analysis Techniques:
  - 5 Whys, Fishbone Diagrams, Fault Tree Analysis
- Prevention Strategies:
  - Material Selection
  - Design Improvements (e.g., fillets, surface treatments)
  - Manufacturing and Quality Controls
- Reporting Findings:
  - Structure of a Failure Analysis Report
  - Legal and Ethical Considerations
- Final Review and Key Takeaways
- Post test
- Feedback and Certification Distribution

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