

Course No. 1285

Materials Selection & Corrosion Control Training Course

CORROSION, INSPECTION & NDT
INDUSTRIAL ENGINEERING, MAINTENANCE & OPERATIONS

DURATION

5 Days

DELIVERY

Classroom



Course Overview

The Materials Selection & Corrosion Control Training Course provides a comprehensive and practical framework for understanding how material selection and corrosion control strategies influence the safety, reliability, durability, and lifecycle performance of industrial assets. The course examines the relationship between material properties, service conditions, degradation mechanisms, equipment design, and corrosion control measures, enabling professionals to make technically informed decisions throughout the asset lifecycle.

Appropriate materials selection is a fundamental requirement for reliable industrial equipment and infrastructure. Selecting materials without adequately considering temperature, pressure, fluid composition, chemical exposure, mechanical loading, environmental conditions, and potential degradation mechanisms can increase the likelihood of corrosion, premature deterioration, unplanned maintenance, and equipment failure. This course provides participants with a structured approach to evaluating material compatibility and selecting suitable materials for demanding operating environments.

The course covers the major forms of corrosion and material degradation, including uniform corrosion, localized corrosion, pitting, crevice corrosion, galvanic corrosion, erosion-corrosion, stress corrosion cracking, corrosion fatigue, high-temperature corrosion, and hydrogen-related damage. Participants will also examine material selection criteria for carbon steels, stainless steels, nickel alloys, copper alloys, aluminum alloys, polymers, coatings, linings, and other engineering materials used in industrial applications.

A major focus of the program is the integration of materials selection with practical corrosion control. Participants will explore corrosion inhibitors, cathodic protection, anodic protection, coatings and linings, material upgrades, environmental control, corrosion monitoring, inspection, and risk-based approaches. The course helps organizations establish more effective corrosion management strategies, improve equipment reliability, reduce degradation-related risks, and support technically sound decisions concerning material selection, maintenance, inspection, and asset integrity.

Objectives

- Analyze the fundamental principles of materials selection and corrosion control and explain their relationship to industrial asset integrity during the course.
- Identify material properties and service conditions that influence material performance in industrial environments.
- Evaluate major corrosion and degradation mechanisms according to material type, operating conditions, process environment, and equipment design.
- Assess the compatibility of engineering materials with specific fluids, chemicals, temperatures, pressures, and environmental conditions.
- Apply structured materials selection criteria to equipment, piping, structural components, and process systems.
- Evaluate the suitability of carbon steels, stainless steels, nickel alloys, copper alloys, aluminum alloys, polymers, coatings, and linings for selected applications.
- Analyze galvanic interactions, localized corrosion risks, erosion-corrosion, cracking mechanisms, and other forms of material degradation.
- Develop practical corrosion control strategies using coatings, inhibitors, cathodic protection, material selection, environmental control, and monitoring.
- Evaluate the effectiveness and limitations of different corrosion prevention and mitigation methods.
- Improve corrosion management decisions by integrating inspection findings, corrosion monitoring data, operating conditions, and material performance information.
- Strengthen coordination between engineering, materials, corrosion, inspection, maintenance, procurement, operations, and asset integrity teams.
- Develop a practical materials selection and corrosion control strategy for a selected industrial asset by the end of the course.

Who Should Attend

The Materials Selection & Corrosion Control Training Course is designed for professionals involved in materials engineering, corrosion engineering, inspection, asset integrity, mechanical engineering, maintenance, reliability, process engineering, fabrication, and equipment design. It is particularly suitable for materials engineers, corrosion engineers, inspection engineers, mechanical engineers, metallurgical engineers, asset integrity engineers, reliability engineers, maintenance engineers, process engineers, welding engineers, and technical specialists responsible for equipment integrity

and material performance.

The course is also relevant to engineering managers, inspection managers, asset integrity managers, maintenance managers, reliability managers, project managers, procurement specialists, technical authorities, quality professionals, and professionals involved in specifying, purchasing, designing, inspecting, maintaining, or operating industrial equipment. It is especially valuable for professionals responsible for pressure equipment, piping systems, storage tanks, heat exchangers, pipelines, process equipment, marine structures, utilities, and other assets exposed to corrosive environments.

Senior managers, asset owners, project decision makers, and multidisciplinary engineering teams can benefit from the course by developing a stronger understanding of how materials selection decisions influence corrosion risk, lifecycle performance, maintenance requirements, and asset reliability. The program also supports effective communication between technical and commercial functions when evaluating material alternatives, corrosion control measures, and lifecycle implications.

Learning Outcomes

- Explain the relationship between material properties, operating conditions, degradation mechanisms, and corrosion performance.
- Identify major corrosion mechanisms and determine the conditions under which each mechanism may occur.
- Evaluate the suitability of different engineering materials for specific industrial service environments.
- Assess the influence of temperature, pressure, fluid chemistry, velocity, contaminants, and environmental exposure on material selection.
- Select appropriate materials for representative equipment, piping, and process applications using structured technical criteria.
- Evaluate galvanic compatibility between dissimilar materials and recommend appropriate control measures.
- Identify risks associated with pitting, crevice corrosion, erosion-corrosion, stress corrosion cracking, corrosion fatigue, and hydrogen-related degradation.
- Compare corrosion prevention and mitigation techniques, including coatings, inhibitors, cathodic protection, material upgrades, and environmental control.

- Develop corrosion control strategies aligned with equipment design, operating conditions, inspection requirements, and asset integrity objectives.
- Evaluate corrosion monitoring and inspection data to identify degradation trends and support corrective action.
- Prepare technical material selection and corrosion control recommendations for industrial projects and existing assets.
- Develop an integrated materials selection and corrosion management strategy for a selected industrial application.

Course Outline

DAY 01

Fundamentals of Materials Selection and Corrosion Engineering

- Introduction to materials selection and corrosion control in industrial asset management.
- Relationship between material properties, equipment design, operating conditions, and asset integrity.
- Mechanical, physical, thermal, and chemical properties of engineering materials.
- Material strength, toughness, hardness, ductility, and temperature resistance.
- Principles of material compatibility and service environment assessment.
- Carbon steels and low-alloy steels in industrial applications.
- Stainless steels and their corrosion resistance characteristics.
- Nickel alloys, copper alloys, aluminum alloys, and other engineering materials.
- Polymers, composite materials, coatings, and linings.
- Material selection considerations during design, procurement, fabrication, and operation.

PRACTICAL APPLICATION

Evaluate material alternatives for a representative industrial system based on operating conditions, performance requirements, and potential degradation mechanisms.

DAY 02

Corrosion Mechanisms and Material Degradation

- Fundamentals of electrochemical corrosion.
- Corrosion cells, anodic and cathodic reactions, and corrosion potential.
- Uniform and general corrosion.
- Pitting and crevice corrosion.
- Galvanic corrosion and dissimilar material combinations.
- Erosion-corrosion and flow-assisted degradation.
- Corrosion under insulation and environmental corrosion.
- Stress corrosion cracking and environmentally assisted cracking.
- Corrosion fatigue and interaction between cyclic loading and corrosion.
- Hydrogen-related damage, hydrogen embrittlement, and related degradation mechanisms.
- High-temperature corrosion and oxidation.

PRACTICAL APPLICATION

Identify potential corrosion mechanisms for selected equipment based on materials, process conditions, fluid chemistry, temperature, pressure, and operating environment.

DAY 03

Materials Selection for Industrial Equipment and Systems

- Developing systematic materials selection methodologies.
- Material selection for pressure vessels and process equipment.
- Material selection for piping systems and pipelines.
- Material selection for heat exchangers and cooling systems.
- Material selection for storage tanks and industrial structures.
- Materials for high-temperature and high-pressure applications.
- Materials for acidic, alkaline, saline, and chemically aggressive environments.
- Evaluating material compatibility with process fluids and contaminants.
- Weldability, fabrication requirements, and material joining considerations.
- Corrosion allowance and its role in equipment design.

DAY 03 — CONTINUED

- Material specifications, technical requirements, and procurement considerations.

PRACTICAL APPLICATION

Develop a material selection matrix for a representative industrial system and justify the selected materials according to service conditions and corrosion risks.

DAY 04

Corrosion Control, Prevention, and Monitoring

- Principles of corrosion prevention and mitigation.
- Coatings and protective lining systems.
- Surface preparation and coating performance considerations.
- Corrosion inhibitors and factors affecting inhibitor effectiveness.
- Cathodic protection principles and applications.
- Anodic protection and its practical applications.
- Environmental control and modification of corrosive operating conditions.
- Material upgrading and corrosion-resistant alloy selection.
- Corrosion monitoring techniques and monitoring locations.
- Corrosion probes, coupons, thickness measurements, and inspection data.
- Integrating corrosion monitoring with inspection and maintenance programs.

PRACTICAL APPLICATION

Develop a corrosion control strategy combining material selection, coatings, inhibitors, monitoring, and inspection for a selected industrial asset.

DAY 05

Integrated Corrosion Management and Asset Integrity

- Developing integrated corrosion management programs.
- Linking materials selection with corrosion risk assessment and asset integrity.
- Identifying critical corrosion circuits and degradation locations.
- Establishing corrosion control and monitoring plans.

DAY 05 — CONTINUED

- Using inspection and monitoring data to evaluate material performance.
- Reviewing corrosion trends and determining appropriate corrective actions.
- Integrating corrosion management with maintenance and reliability planning.
- Managing material changes, process changes, and operating condition changes.
- Technical documentation, material specifications, corrosion control procedures, and reporting.
- Evaluating lifecycle implications of material selection and corrosion control decisions.
- Improving coordination between engineering, inspection, maintenance, procurement, operations, and asset integrity teams.

FINAL WORKSHOP

Develop a comprehensive Materials Selection & Corrosion Control strategy for a selected industrial asset, including service conditions, material requirements, applicable corrosion mechanisms, material selection, corrosion allowance, prevention and mitigation measures, monitoring methods, inspection requirements, maintenance considerations, and lifecycle recommendations.

Register or Request More Information

Course page: <https://quest-training.com/courses/materials-selection-corrosion-control-training-course>

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