



Asia Masters Center

Corrosion and Corrosion Protection of Materials



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Corrosion and Corrosion Protection of Materials



Course Overview:

This course is designed to provide participants with a solid grounding in Corrosion and the destructive attack of a metal by chemical or electrochemical reaction with its environment. The different ways to control the corrosion and to protect the industrial structures including buried and subsea pipelines, storage tanks, petrochemical plants and concrete structures.



Course Objective

After completing this course participants will be able to:

- To identify the corrosion mechanism, estimate and predict the corrosion rate.
- To select material for different corrosion environment.
- It provides theoretical knowledge and fundamentals for modern Cathodic protection engineering design, installation, operation and repair.
- Design for sacrificial Cathodic protection & impressed current Cathodic protection and Cathodic protection rectifiers including their design, use and application.
- Testing on both sacrificial and impressed current Cathodic protection systems.
- To evaluate and select corrosion inhibitor for different corrosion environments.
- Protection by Coating.
- Using Nanotechnology in corrosion protection of materials.



➔ Target Audience

- This course will have a particular focus for people working in the Electric power stations, Water Desalination plant and Oil & Gas production and process control Engineers, Production supervisors, maintenance engineers and supervisors.

➔ Course Outline

The Module (01) DEFINITION AND IMPORTANCE OF CORROSION

- 1.1 Corrosion Science and Corrosion Engineering.
- 1.2 Importance of Corrosion.
- 1.3 Risk Management.
- 1.4 Causes of Corrosion.
- 1.5 Change in Gibbs Free Energy.
- 1.6 Pilling-Bedworth Ratio.

Module (02) ELECTROCHEMICAL MECHANISMS.

- 2.1 The Dry-Cell Analogy and Faraday's Law.
- 2.2 Definition of Anode and Cathode.
- 2.3 Types of Cells.
- 2.4 Types of Corrosion Damage.

Module (03) THERMODYNAMICS: CORROSION TENDENCY AND ELECTRODE POTENTIALS.

- 3.1 Change of Gibbs Free Energy.
- 3.2 Calculating the Half-Cell Potential - The Nernst Equation.
- 3.4 The Hydrogen Electrode and the Standard Hydrogen Scale.
- 3.5 Convention of Signs and Calculation of emf.
- 3.6 Measurement of pH.
- 3.7 The Oxygen Electrode and Differential Aeration Cell.



Module (04) ATMOSPHERIC CORROSION.

- 4.1 Types of Atmospheres.
- 4.2 Corrosion-Product Films.
- 4.3 Factors Influencing Corrosivity of the Atmosphere.
- 4.4 Remedial Measures.

Module (5) OXIDATION.

- 5.1 Thermodynamics of Oxidation: Free Energy-Temperature Diagram.
- 5.2 Protective and Non protective Scales.
- 5.3 Oxide Properties and Oxidation.
- 5.4 Galvanic Effects and Electrolysis of Oxides.
- 5.5 Hot Corrosion.
- 5.6 Oxidation of Copper.
- 5.7 Oxidation of Iron and Iron Alloys.

Module (06) KINETICS: POLARIZATION AND CORROSION RATES.

- 6.1 Polarization.
- 6.2 The Polarized Cell.
- 6.3 How Polarization Is Measured.
- 6.4 Causes of Polarization.
- 6.5 Hydrogen Over potential.
- 6.6 Influence of Polarization on Corrosion Rate.
- 6.7 Calculation of Corrosion Rates from Polarization Data.
- 6.8 Anode-Cathode Area Ratio.
- 6.9 Electrochemical Impedance Spectroscopy.
- 6.10 Theory of Cathodic Protection.

Module (07) PASSIVITY.

- 7.1 Definition.
- 7.2 Characteristics of Passivation and the Flade Potential.
- 7.3 Behavior of Passivators.



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- 7.4 Anodic Protection and Trans passivity.
- 7.5 Theories of Passivity.
- 7.6 Critical Pitting Potential.
- 7.7 Critical Pitting Temperature.
- 7.8 Passivity of Alloys.

Module (08) IRON AND STEEL.

- 8.1 Aqueous Environments.
 - • Effect of Dissolved Oxygen.
 - • Effect of Temperature.
 - • Effect of pH.
 - • Effect of Galvanic Coupling.
 - • Effect of Velocity on Corrosion in Natural Waters.
 - • Effect of Dissolved Salts.
- 8.2 Metallurgical Factors.
 - • Varieties of Iron and Steel.
 - • Effects of Composition.
 - • Effect of Heat Treatment.
- 8.3 Steel Reinforcements in Concrete.

Module (09) EFFECT OF STRESS.

- 9.1 Cold Working.
- 9.2 Stress-Corrosion Cracking.
- 9.3 Mechanism of Stress-Corrosion Cracking of Steel and Other Metals.
- 9.4 Hydrogen Damage.
- 9.5 Radiation Damage.
- 9.6 Corrosion Fatigue.

Module (10) CATHODIC PROTECTION.

- 10.1 Brief History.
- 10.2 How Applied.



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- • Mechanism of Cathodic Protection, Equivalent Circuits, Types of Cathodic Protection
- • Systems Cathodic Protection Measurements.
- 10.3 Sacrificial Anodes.
- Principals, Design, Fabrication of Anodes, Effectiveness Monitoring.
- 10.4 Combined Use with Coatings.
- 10.5 Magnitude of Current Required.
- 10.6 Anode Materials and Backfill.
- • Overprotection.
- 10.7 Criteria of Protection.
- • Potential Measurements.
- • Position of Reference Electrode.
- 10.8 Economics of Cathodic Protection.

Module (11) METALLIC COATINGS.

- 11.1 Methods of Application.
- 11.2 Classification of Coatings.
- 11.3 Specific Metal Coatings.
- • Nickel Coatings.
- • Lead Coatings.
- • Zinc Coatings.
- • Cadmium Coatings.
- • Tin Coatings.
- • Chromium-Plated Steel for Containers.
- • Aluminum Coatings.

Module (12) INORGANIC COATINGS and ORGANIC COATINGS.

- 12.1 Vitreous Enamels.
- 12.2 Portland Cement Coatings.
- 12.3 Chemical Conversion Coatings.



Module (13) INHIBITORS AND PASSIVATORS.

- 13.1 Mechanism of Passivation.
- 13.2 Applications of Passivators.
- 13.3 Pickling Inhibitors.
- 13.4 Vapor-Phase Inhibitors.
- 13.5 Inhibitor to Reduce Tarnishing of Copper.

**Module (14) ALLOYING FOR CORROSION RESISTANCE;
STAINLESS STEELS.**

- 14.1 Stainless Steels.
- 14.2 Classes and Types.
- 14.3 Intergranular Corrosion.
- 14.4 Pitting and Crevice Corrosion.
- 14.5 Stress-Corrosion Cracking and Hydrogen Cracking.
- 14.6 Cracking of Sensitized Austenitic Alloys in Polythionic Acids.
- 14.7 Galvanic Coupling and General Corrosion Resistance.

Module (15) Using Nanotechnology in corrosion protection of materials

- 15.1 Using Nanotechnology in endowing the steel bulk materials with excellent corrosion resistance and other enhanced properties.
- 15.2 Using Nanotechnology to produce protective coatings superior abrasion resistance.
- 15.3 Using Nanotechnology in surface treatments to improve the performance and service life of Steel and other alloys used in oxidizing and corrosive environments.
- 15.4 Using Nanotechnology in preparing nano-sized additives for coatings used to protect steel and other metals from corrosive environments.



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- 15.5 Nanotechnology for Intelligent Corrosion Protection Systems.
- Course Summary & Conclusion

The Feature Of Asia Master Training And Development Center

- we pick up the customer from the airport to the hotel.
- we give the participant training bag includes all the necessary tools for the course.
- Working within groups to achieve the best results.
- All our courses are confirmed and we do not postpone or cancel the courses regardless of the number of participants in the course.
- We can assist you in booking hotels at discounted prices if you wish to book through us.
- We offer the certificate from Asia Masters Center for Training and Administrative Development.

➔ The Cost Of The Training Program Includes The Following:

- 1) Scientific article on flash memory.
- 2) Training Room.
- 3) Training.
- 4) Coffee break.
- 5) The training bag includes all the tools for the course.



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Price (USD)

Communicate with the training department
to know the participation fees

➤ **There are offers and discounts for groups**

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