CORROSION FOR NON-CORROSION ENGINEERS

MAESTRO CONSULTANTS

CONTACT US ON:

T: +971 7 2042072 | Email: training@maestrouae.net

Website: www.maestrouae.net

TRAINING TITLE

CORROSION FOR NON-CORROSION ENGINEERS

VENUE

Dubai, UAE

DURATION

5 Days

DATES

18 - 22 September 2022

PRICE

US$4,000 per attendee including training material/handouts, morning/afternoon coffee breaks and Lunch buffet.

TRAINING INTRODUCTION

An understanding of corrosion and its control is vital for engineers working in energy industry to avoid the high costs that can be directly or indirectly attributed to corrosion. This course presents fundamental principles of corrosion, helping engineers recognize corrosion problems, determine their causes, and understands and then select control methods.

TRAINING OBJECTIVES

- To understand metallurgical properties of metals and alloys.
- To understand fundamental principles and mechanisms of corrosion phenomenon.
- To know the characteristics and types of corrosion encountered in the metal materials used the chemical and oil and gas industries.
- To know how to recognize corrosion problems, determine their causes and to select control methods.
- To be aware of the means of protection against such corrosion.
- To know how to take the necessary measures for monitoring the state of corrosion of the equipment. To understand corrosion test methods and interpretation of results. To understand the application of corrosion protection techniques. To understand how to develop and implement corrosion control programs.

TRAINING AUDIENCE

Newly appointed Engineers of Mechanical, Chemical and Electric Power Engineering disciplines.

TRAINING OUTLINE

Introduction

Definition of corrosion, Types of corrosion, The cost of corrosion, Significance of corrosion control.

Electrical concepts relevant to corrosion:

Resistivity, conductivity, impedance, Electron conductor, electrolytic (ionic) conductor and semiconductor, Direction of current and flow of electrons.

Matters of Substance:

Metals in the melting pot, Defects in metals.

Chemical and electrochemical concepts relevant to corrosion:

Ionization of water, Definition of pH, Ionization of metal in water, Electrode process, Anodic and cathodic reactions, Passivation behavior of iron in nitric acid, Standard redox potential, EMF series, Common reference electrodes, The Daniel cell and Galvanic cell, Galvanic series, Essential components in a corrosion cell, Common types of corrosion cells in practical situations, General methods of corrosion control.

Thermodynamic aspects of aqueous corrosion:

Stable states of metals in nature, The driving force for corrosion, The energy change and the cell potential, Faraday's Law Effect of concentration, the Nernst Equation, Effect of pH, the potential-pH diagram (Pourbaix diagram) Practical applications of E-pH diagram and its limitations.

Kinetics of corrosion:

Rate of reaction and rate constant, Factors affect rate of reaction, Anodic and cathodic current densities, Exchange current density, The mixed potential theory, E-log(i) Evans diagram, Tafel Equation and Tafel plot for corrosion rate determination, Linear polarization and Stern-Geary, Equation Type of polarization and rate-controlling step, Concentration polarization and the importance of dissolved oxygen Effect of oxidizer concentration on corrosion rate, Effect of velocity on corrosion rate.

Oxidation of metals & alloys:

Mechanisms of ionic movements in metallic oxides, Rate of oxidation and rate laws, Effects of alloying elements on the protective property of oxides, Oxidation resistance of low-alloy steel, Factors governing oxidation behavior, Oxidation of iron, Alloying effects on oxidation of iron Stress effects, Commercial low-alloy steels in air or oxygen.

Nature of environments:

Air and oxygen, Steam, Sulphur-containing gases, olten salts, Molten metals.

Materials for high temperature applications:

Oxidation, Sulphidation, Hot-salt corrosion, Carburisation and attack by carbon-containing gases, Corrosion by molten metals and salts, Corrosion of advanced ceramics.

Forms of Corrosion:

Uniform corrosion, Galvanic corrosion, Dealloying and Graphitisation, Crevice corrosion, Pitting corrosion, Intergranular stress corrosion cracking, weld decay and knife-line attack, Exfoliation, Filiform corrosion, Microbiologically-Influenced Corrosion (MIC), Environment-sensitive cracking, Stress corrosion cracking (SCC), Hydrogen-induced cracking (HIC), Sulfide stress cracking (SSC), Caustic embrittlement Liquid metal embrittlement (LME) Hydrogen, Damage Cold hydrogen attack or hydrogen blistering, Hot hydrogen attack or decarburization (methane gas embrittlement), Hydride (MHx) embrittlement, Hydrogen Induced Cracking (HIC), Stress Oriented Hydrogen, Induced Cracking (SOHIC) Sulfide Stress Corrosion Cracking (SSC), Corrosion fatigue, Fretting, Erosion corrosion, impingement attack and cavitation damage, Stray current corrosion.

Corrosion in atmospheres:

Type of atmospheres and classification of corrosiveness, Importance of relative humidity on rate of corrosion, Other major factors affect the rate of corrosion, Common forms of corrosion encountered in atmospheres, Corrosion behavior of common engineering materials under atmospheric, condition, Corrosion in potable water. natural waters and seawater systems, Compositions of waters, Effect of pH, Corrosion resistance of common metals and alloys in water systems.

Corrosion in Soils:

Characterisation of the soil environment, Soil resistivity and rate of corrosion, Other factors affect the form and rate of corrosion, Corrosion resistance of common metals and alloys in soil, Corrosion control and prevention methods.

Corrosion in Concrete Structures:

Characteristics of the concrete environment, Mechanisms of reinforcement corrosion.

Corrosion control prevention methods:

Materials selection, Protective coatings, Cathodic protection, Change of environment, Change in design.

Identification of Corrosion Problems:

Visual observation, Non-destructive inspection, Destructive evaluations.

Corrosion Monitoring & Testing:

Accelerated corrosion testing, Field corrosion testing.

Corrosion resistance of other common engineering materials:

Cast iron, Carbon steels and low alloys steels, Stainless steels, Nickel and nickel alloys, Aluminum and aluminum alloys, Copper and copper alloys, Titanium and titanium alloys, Zinc, tin and their alloys.

Corrosion resistance of non-metallic materials:

Plastics, rubber, elastomers and vitreous materials, Composite materials, Ceramic materials.

TRAINING CERTIFICATE

MAESTRO CONSULTANTS Certificate of Completion for delegates who attend and complete the training course

METHODOLOGY

Our courses are highly interactive, typically taking a case study approach that we have found to be an effective method of fostering discussions and transferring knowledge. Participants will learn by active participation during the program through the use of individual exercises, questionnaires, team exercises, training videos and discussions of "real life" issues in their organizations.
The material has been designed to enable delegates to apply all of the material with immediate effect back in the workplace.