

Glossary of Corrosion Related Terms

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Active: Refers to the negative direction of electrode potential. Also used to describe a metal that is corroding without significant influence of reaction product.

Anaerobic: Free of air or uncombined oxygen.

Anion: A negatively charged ion of an electrolyte, which migrates toward the anode under the influence of a potential gradient.

Anode: An electrode at which oxidation of its surface or some component of the solution is occurring. Antonym: cathode.

Bituminous Coating: Coal tar or asphalt based coating.

Cathode: The electrode of an electrolytic cell at which reduction occurs.

Cathodic Protection: A technique to prevent the corrosion of a metal surface by making that surface the cathode of an electrochemical cell.

Cation: A positively charged ion of an electrolyte, which migrates toward the cathode under the influence of a potential gradient.

Cell: Electrochemical system consisting of an anode and a cathode immersed in an electrolyte. The anode and a cathode may be separate metals or dissimilar areas on the same metal.

Continuity Bond: A metallic connection that provides electrical continuity.

Corrosion: The deterioration of a material, usually a metal, because of a reaction with its environment.

Corrosion Potential (E_{corr}): The potential of a corroding surface in an electrolyte, relative to a reference electrode. Also called: rest potential, open circuit potential, freely corroding potential.

Current Density: The current per unit area.

Differential Aeration Cell: An electrolytic cell, the EMF of which is due to difference in air

(oxygen) concentration at one electrode as compared with that at another electrode of the same material.

Electrical Isolation: The condition of being electrically separated from other metallic structures and the environment.

Electrochemical Equivalent: The weight of an element or group of elements oxidized or reduced at 100% efficiency by the passage of a unit quantity of electricity. Usually expressed as grams per coulomb.

Electrode Potential: The potential of an electrode as measured against a reference electrode. The electrode potential does not include any loss of potential in the solution due to current passing to or from the electrodes, i.e., it represents the reversible work required to move a unit charge from the electrode surface through the solution to the reference electrode.

Electrolyte: A chemical substance or mixture, usually liquid, containing ions that migrate in an electric field. For use in this text, electrolyte refers to the soil or liquid adjacent to and in contact with a buried or submerged metallic structure, including the moisture and other chemicals contained therein.

Electromotive Force Series (EMF Series): A list of elements arranged according to their standard electrode potentials, the sign being positive for elements whose potentials are cathodic to hydrogen and negative for those anodic to hydrogen.

Environment: The surroundings or conditions (physical, chemical, mechanical) in which a material exists.

Epoxy: Resin formed by the reaction of bisphenol and epichlorohydrin.

Equilibrium Potential: The electrode potential with reference to a standard equilibrium, as defined by the Nernst equation.

Foreign Structure: Any structure that is not intended as a part of the system of interests.

Galvanic Anode: A metal which, because of its relative position in the galvanic series, provides sacrificial protection to metal or metals that are more noble in the series, when coupled in an electrolyte. These anodes are the current source in one type of cathodic protection.

Galvanic Corrosion: Corrosion associated with the current resulting from the electrical coupling of dissimilar electrodes in an electrolyte.

Galvanic Series: A list of metals and alloys arranged according to their relative potentials in a given environment.

General Corrosion: A form of deterioration that is distributed more or less uniformly over a surface.

Graphitic Corrosion: Deterioration of cast and ductile iron in which the metallic constituents are selectively leached or converted to corrosion products leaving the graphite intact.

Ground Bed: A buried item, such as junk steel or graphite rods, which serves as the anode for the cathodic protection of pipelines or other buried structures.

Half Cell: See Reference Electrode.

Holiday: Any discontinuity or bare spot in a coated surface.

Impressed Current: Direct current supplied by a power source external to the electrode system.

Inhibitor: A chemical substance or combination of substances, which when present in the proper concentration and forms in the environment, prevents or reduces corrosion.

Insulating Coating System: All components comprising the protective coating, the sum of which provides effective electrical insulation of the coated structure.

Interference Bond: A metallic connection designed to control electrical current interchange between metallic systems.

Ion: An electrically charged atom or group of atoms.

IR Drop: The voltage dropped across a resistance in accordance with Ohm's law.

Isolation: See Electrical Isolation.

Mixed Potential: A potential resulting from two or more electrochemical reactions occurring simultaneously on one metal surface.

Open Circuit Potential: Same as Corrosion Potential.

Noble: Referring to positive direction of electrode potential, thus resembling noble metals such as gold and platinum.

Over-voltage: The difference between the given and equilibrium electrode potentials of an electrode due to net current flow.

Oxidation: Loss of electrons by a constituent of a chemical reaction.

Oxygen Concentration Cell: See Differential Aeration Cell.

Passivation: A reduction of the anodic reaction rate of an electrode involved in corrosion.

Pits: Localized corrosion of a metal surface, confined to a small area which takes the form of cavities.

Polarization: The deviation from the open circuit potential of an electrode resulting from the passage of current. In this text, polarization is considered to be the change in potential of a metal surface resulting from the passage of current directly to or from an electrolyte.

Primer: First coat of paint applied to a surface. Formulated to have good bonding and wetting characteristics; may or may not contain inhibitive pigments.

Profile: Anchor pattern on a surface produced by abrasive blasting or acid treatment.

Reduction: Gain of electrons by a constituent of a chemical reaction.

Reference Electrode: A device whose open circuit potential is constant under similar conditions of measurement.

Rust: Corrosion product consisting primarily of hydrated iron oxides, a term properly applied only to iron and ferrous alloys.

Sacrificial Protection: Reduction or prevention of corrosion of a metal in an electrolyte by galvanically coupling it to a more anodic metal.

Stray Current: Current flowing through paths other than the intended circuit.

Stray Current Corrosion: Corrosion resulting from direct current flowing through paths other than the intended circuit.

Structure-to-Electrode Voltage: (Also Structure-to-Soil Potential or Pipe-to-Soil Potential). The voltage difference between a buried metallic structure and the electrolyte that is measured with reference to an electrode in contact with the electrolyte.

Structure-to-Structure Voltage: (Also Structure-to-Structure Potential). The difference in voltage between metallic structures in a common electrolyte.

Tafel Segment, Tafel Line, Tafel Slope, and Tafel Diagram: When an electrode is polarized, it frequently will yield a current-potential relationship over a region that can be approximated by:

$$\eta = \pm B \log(i/i_0)$$

where:

η = change from open circuit potential caused by “ i ” current flow between the metal and environment,

i = the net current density for the system metal and environment,

B = is a constant for the system metal and environment,

i_0 = is a constant for the system. It is the exchange current density equivalent to the equal forward and reverse reactions current flow at equilibrium.

The constant (B) is also known as the Tafel slope. If this behavior is observed, a plot on semilogarithmic coordinates is known as the Tafel line and the overall diagram is termed a Tafel diagram. The Tafel segment is that portion of the diagram that appears as a straight line when current is plotted on the logarithmic scale and potential change is plotted on the linear scale. The beginning of the Tafel segment is the point on the curve where the current-potential relationship follows the straight line with increasing current increments and deviated from the straight line with decreasing current increments.