



# Ithuta JV

Holthuta Ka Tsebo  
Learning from Experience

## **CORROSION RISK MANAGEMENT GLOSSARY**

### **Acid Rain**

Atmospheric precipitation with a pH below 3.6 to 5.7. Burning of fossil fuels for heat and power is the major factor in the generation of oxides of nitrogen and sulfur, which are converted into nitric and sulfuric acids washed down in the rain.

### **Active**

A state in which a metal tends to corrode; referring to the negative direction of electrode potential (opposite of passive or noble).

### **Active Metal**

A metal ready to corrode, or being corroded

### **Active Potential**

The *potential* of a corroding material.

### **Anion**

An ion or radical which is attracted to the anode because of the negative charge.

### **Anode**

The electrode at which oxidation or corrosion of some component occurs (opposite of cathode). Electrons flow away from the anode in the external circuit.

### **Anodic Protection**

A technique to reduce corrosion of a metal surface under some conditions by passing sufficient current to it to cause its electrode potential to enter and remain in the passive region; imposing an external electrical potential to protect a metal from corrosive attack. (Applicable only to metals that show active-passive behavior.)

### **Atmospheric Corrosion.**

The gradual degradation or alteration of a material by contact with substances present in the atmosphere, such as oxygen, carbon dioxide, water vapor, and sulfur and chlorine compounds.

### **Austenitic**

The name given to the face-centered cubic crystal structure (FCC) of ferrous metals. Ordinary iron and steel has this structure at elevated temperatures; also certain stainless steels (300 series) have this structure at room temperature.

### **Bimetallic Corrosion**

(Galvanic Corrosion) Corrosion resulting from dissimilar metal contact.

### **Cathode.**

The *electrode* of an *electrolytic cell* at which reduction is the principal reaction. (Electrons flow toward the cathode in the external circuit.) Typical cathodic processes are cations taking up electrons and being discharged, oxygen being reduced, and the reduction of an element or group of elements from a high to a lower valence state. Contrast with *anode*.

### **Cathodic Protection.**

(1) Reduction of corrosion rate by shifting the *corrosion potential* of the electrode toward a less oxidizing potential by applying an external *electromotive force*. (2) Partial or complete protection of a metal from corrosion by making it a *cathode*, using either a galvanic or an impressed current. Contrast with *anodic protection*.

### **Cathodic Reaction.**

Electrode reaction equivalent to a transfer of negative charge from the electronic to the ionic conductor. A cathodic reaction is a reduction process. An example common in corrosion is:  $Ox + ne \rightarrow Red$ .

### **Cell.**

Electrochemical system consisting of an *anode* and a *cathode* immersed in an *electrolyte*. The anode and cathode may be separate metals or dissimilar areas on the same metal. The cell includes the external circuit, which permits the flow of electrons from the anode toward the cathode. See also *electrochemical cell*.

**Concentration Cell.**

An *electrolytic cell*, the *electromotive force* of which is caused by a difference in concentration of some component in the electrolyte. This difference leads to the formation of discrete *cathode* and *anode* regions.

**Corrosion Product.**

Substance formed as a result of *corrosion*.

**Corrosion Protection.**

Modification of a *corrosion system* so that corrosion damage is mitigated.

**Corrosion Rate.**

*Corrosion effect* on a metal per unit of time. The type of corrosion rate used depends on the technical system and on the type of corrosion effect. Thus, corrosion rate may be expressed as an increase in corrosion depth per unit of time (penetration rate, for example, mils/yr.) or the mass of metal turned into corrosion products per unit area of surface per unit of time (weight loss, for example, g/m<sup>2</sup>/yr.). The corrosion effect may vary with time and may not be the same at all points of the corroding surface. Therefore, reports of corrosion rates should be accompanied by information on the type, time dependency, and location of the corrosion effect.

**Corrosion Resistance.**

Ability of a metal to withstand *corrosion* in a given *corrosion system*.

**Corrosion Risk**

An identified threat or risk indicating a probability or possibility of corrosion

**Corrosion System.**

System consisting of one or more metals and all parts of the environment that influence *corrosion*.

**Corrosivity.**

Tendency of an environment to cause *corrosion* in a given *corrosion system*.

**Crevice Corrosion.**

*Localized corrosion* of a metal surface at, or immediately adjacent to, an area that is shielded from full exposure to the environment because of close proximity between the metal and the surface of another material.

**Deposit**

Foreign substance which comes from the environment, adhering to a surface of a material

**Elastomer.**

A natural or synthetic polymer, which at room temperature can be stretched repeatedly to at least twice its original length, and which after removal of the tensile load will immediately and forcibly return to approximately its original length.

**Electrochemical Cell.**

An electrochemical system consisting of an anode and a cathode in metallic contact and immersed in an electrolyte. (The anode and cathode may be different metals or dissimilar areas on the same metal surface).

**Electrochemical Corrosion.**

Corrosion that is accompanied by a flow of electrons between cathodic and anodic areas on metallic surfaces.

**Electrochemical Potential.**

The partial derivative of the total electrochemical free energy of a constituent with respect to the number of moles of this constituent where all factors are kept constant. It is analogous to the chemical potential of a constituent except that it includes the electric as well as chemical contributions to the free energy. The potential of an electrode in an electrolyte relative to a reference electrode measured under open circuit conditions.

**Electrode.**

(1) An electronic conductor used to establish electrical contact with an electrolytic part of a circuit. (2) An electronic conductor in contact with an ionic conductor.

**Electrode Potential.**

The potential of an electrode in an electrolyte as measured against a reference electrode. The electrode potential does not include any resistance losses in potential in either the solution or external circuit. It represents the reversible work to move a unit charge from the electrode surface through the solution to the reference electrode.

**Electrolyte.**

(1) A chemical substance or mixture, usually liquid, containing ions that migrate in an electric field. (2) A chemical compound or mixture of compounds which when molten or in solution will conduct an electric current.

**Electromotive Force Series (emf series).**

A list of elements arranged according to their standard electrode potentials, with "noble" metals such as gold being positive and "active" metals such as zinc being negative.

**Erosion.**

Destruction of metals or other materials by the abrasive action of moving fluids, usually accelerated by the presence of solid particles or matter in suspension. When corrosion occurs simultaneously, the term erosion-corrosion is often used.

**Erosion-Corrosion.**

A conjoint action involving corrosion and erosion in the presence of a moving corrosive fluid, leading to the accelerated loss of material.

**Failure.**

A general term used to imply that a part in service (1) has become completely inoperable, (2) is still operable but is incapable of satisfactorily performing its intended function, or (3) has deteriorated seriously, to the point that it has become unreliable or unsafe for

**Fetting corrosion.**

The accelerated deterioration at the interface between contacting surfaces as the result of corrosion and slight oscillatory movement between the two surfaces; Deterioration at the interface between two contacting surfaces accelerated by relative motion between them of sufficient amplitude to produce slip.

**Galvanic Corrosion**

Pertaining to the current resulting from the coupling of dissimilar electrodes in an electrolyt

**Galvanic Cell.**

A cell in which chemical change is the source of electrical energy. It usually consists of two dissimilar conductors in contact with each other and with an electrolyte. or of two similar conductors in contact with each other and with dissimilar electrolytes.

**Galvanic Couple.**

A pair of dissimilar conductors, commonly metals, in electrical contact. See also *galvanic corrosion*

**Galvanic Series.**

A list of metals and alloys arranged according to their relative corrosion potentials in a given environment. Compare with *electromotive series*.

**Galvanize.**

To coat a metal surface with zinc using any of various processes.

**General Corrosion.**

A form of deterioration that is distributed more or less uniformly over a surface; See *uniform corrosion*.

**Industrial Atmosphere.**

An atmosphere in an area of heavy industry with soot, fly ash, and sulfur compounds as the principal constituents.

**Inhibitor.**

A chemical substance or combination of substances that, when present in the environment, prevents or reduces corrosion without significant reaction with the components of the environment.

**Local cell.**

A *galvanic cell* resulting from inhomogeneities between areas on a metal surface in an *electrolyte*. The inhomogeneities may be of physical or chemical nature in either the metal or its environment.

**Localized Corrosion.**

Corrosion at discrete sites, *stress-corrosion cracking*.

**Noble.**

The positive direction of *electrode potential*, thus resembling noble metals such as gold and platinum.

**Noble Metal.**

(1) A metal whose *potential* is highly positive relative to the hydrogen electrode. (2) A metal with marked resistance to chemical reaction, particularly to oxidation and to evolution by inorganic acids. The term as often used is synonymous with *precious metal*.

**Noble Potential.**

A *potential* more cathodic (positive) than the standard hydrogen potential.

**Oxidation.**

(1) A reaction in which there is an increase in valence resulting from a loss of electrons. Contrast with *reduction*. (2) A corrosion reaction in which the corroded metal forms an oxide; usually applied to reaction with a gas containing elemental oxygen, such as air.

**Oxidized Surface (on steel).**

Surface having a thin, tightly adhering, oxidized skin (from straw to blue in color), extending in from the edge of a coil or sheet.

**Oxidizing Agent.**

A compound that causes *oxidation*, thereby itself being reduced.

**Oxygen Concentration Cell.**

A galvanic cell resulting from difference in oxygen concentration between two locations;

**Passivation.**

(1) A reduction of the anodic reaction rate of an electrode involved in corrosion. (2) The process in metal corrosion by which metals become *passive*. (3) The changing of a chemically active surface of a metal to a much less reactive state. Contrast with *activation*.

**Passivator.**

A type of *inhibitor* that appreciably changes the potential of a metal to a more noble (positive) value.

**Passive.**

(1) A metal corroding under the control of a surface reaction product. (2) The state of the metal surface characterized by low corrosion rates in a potential region that is strongly oxidizing for the metal. (3) The state of a metal when its behavior is much more noble than its position in the EMF series would predict. This is a surface phenomena.

**Passive-Active cell.**

(1) A cell, the emf of which is due to the potential difference between a metal in an active state and the same metal in a passive state. (2) A corrosion cell in which the *anode* is a metal in the *active* state and the *cathode* is the same metal in the *passive* state.

**Passivity.**

A condition in which a piece of metal, because of an impervious covering of oxide or other compound, has a *potential* much more positive than that at the metal in the active state.

**pH.**

A measure of the acidity or alkalinity of a solution; The negative logarithm of the hydrogen-ion activity; it denotes the degree of acidity or basicity of a solution. At 25 °C (77 °F), 7.0 is the neutral value. Decreasing values below 7.0 indicate increasing acidity; increasing values above 7.0, increasing basicity.

**Pitting.**

*Localized corrosion* of a metal surface, confined to a point or small area, that takes the form of cavities or pits.

**Potential.**

Any of various functions from which intensity or velocity at any point in a field may be calculated. The driving influence of an electrochemical reaction. See also *active potential, chemical potential, corrosion potential, critical pitting potential, decomposition potential, electrochemical potential, electrode potential, electrokinetic potential, equilibrium (reversible) potential, free corrosion potential, noble potential, open-circuit potential, protective potential, redox potential, and standard electrode potential.*

**Rust.**

A visible corrosion product consisting of hydrated oxides of iron. Applied only to ferrous alloys. See also *white rust.*

**Sacrificial protection.**

Reduction of corrosion of a metal in an *electrolyte* by galvanically coupling it to a more anodic metal; a form of *cathodic protection.*

**Stress-corrosion Cracking (SCC).**

A cracking process that requires the simultaneous action of a corrodent and sustained tensile stress. This excludes corrosion-reduced sections that fail by fast fracture. It also excludes intercrystalline or transcrystalline corrosion, which can disintegrate an alloy without applied or residual stress. Stress-corrosion cracking may occur in combination with *hydrogen embrittlement.*

**Threat** (also often called a Hazard)

A specific factor or circumstance, or a set of factors or a range of circumstances, in either or both the internal or external environments of a company. The Threat represents a potential change in the conditions under which the course of action is being planned or implemented and thereby considered as having a significant influence of the objectives at some time in the future.