Glossary of Corrosion RelatedTerms

NACE INTERNATIONAL
THE CORROSION SOCIETY

Item No. 26012

NACE GLOSSARY OF CORROSION-RELATED TERMS

ABRASIVE
Small particles of material that are propelled at high velocity to impact a surface during abrasive blast cleaning.

ABRASIVE BLAST CLEANING
Cleaning and roughening of a surface produced by the high-velocity impact of an abrasive that is propelled by the discharge of pressurized fluid from a blast nozzle or by a mechanical device such as a centrifugal blasting wheel. (Also referred to as *Abrasive Blasting*.)

ACCELERATOR
A chemical substance that increases the rate at which a chemical reaction (e.g., curing) would otherwise occur.

ACRYLIC
Type of resin polymerized from acrylic acid, methacrylic acid, esters of these acids, or acrylonitrile.

ACTIVATOR
A chemical substance that initiates and accelerates a chemical reaction (e.g., curing). Heat and radiation may also serve as activators for some chemical reactions.

ACTIVE
(1) The negative direction of electrode potential. (2) A state of a metal that is corroding without significant influence of reaction product.

AERATION CELL
[See *Differential Aeration Cell*.]

AIR DRYING
Process by which an applied wet coat converts to a dry coating film by evaporation of solvent or reaction with oxygen as a result of simple exposure to air without intentional addition of heat or a curing agent.

AIRLESS SPRAYING
Process of spraying coating liquids using hydraulic pressure, not air pressure, to atomize.

ALKYD
Type of resin formed by the reaction of polyhydric alcohols and polybasic acids, part of which is derived from saturated or unsaturated oils or fats.

ALLIGATORING
Pronounced wide cracking over the surface of a coating, which has the appearance of alligator hide.

AMPHOTERIC METAL
A metal that is susceptible to corrosion in both acid and alkaline environments.

ANAEROBIC
Free of air or uncombined oxygen.

ANION
A negatively charged ion that migrates through the electrolyte toward the anode under the influence of a potential gradient.

ANODE
The electrode of an electrochemical cell at which oxidation occurs. Electrons flow away from the anode in the external circuit. Corrosion usually occurs and metal ions enter the solution at the anode.

ANODE CAP
An electrical insulating material placed over the end of the anode at the lead wire connection.

ANODE CORROSION EFFICIENCY
The ratio of the actual corrosion (mass loss) of an anode to the theoretical corrosion (mass loss) calculated from the quantity of electricity that has passed between the anode and cathode using Faraday's law.

ANODIC INHIBITOR
A chemical substance that prevents or reduces the rate of the anodic or oxidation reaction.

ANODIC POLARIZATION
The change of the electrode potential in the noble (positive) direction caused by current across the electrode/electrolyte interface. [*See Polarization*.]

ANODIC PROTECTION
Polarization to a more oxidizing potential to achieve a reduced corrosion rate by the promotion of passivity.

ANODIZING
Oxide coating formed on a metal surface (generally aluminum) by an electrolytic process.

ANOLYTE
The electrolyte adjacent to the anode of an electrochemical cell.

ANTIFOULING
Preventing fouling. [See *Fouling*.]

ATTENUATION
Electrical losses in a conductor caused by current flow in the conductor.

AUGER ELECTRON SPECTROSCOPY
Analytical technique in which the sample surface is irradiated with low-energy electrons and the energy spectrum of electrons emitted from the surface is measured.

AUSTENITIC STEEL
A steel whose microstructure at room temperature consists predominantly of austenite.

AUXILIARY ELECTRODE
An electrode, usually made from a noncorroding material, which is commonly used in polarization studies to pass current to or from a test electrode.

BACKFILL
Material placed in a hole to fill the space around the anodes, vent pipe, and buried components of a cathodic protection system.

BARRIER COATING
(1) A coating that has a high resistance to permeation of liquids and/or gases. (2) A coating that is applied over a previously coated surface to prevent damage to the underlying coating during subsequent handling

BEACH MARKS
The characteristic markings on the fracture surfaces produced by fatigue crack propagation (also known as *clamshell marks, conchoidal marks*, and *arrest marks*).

BETA CURVE
A plot of dynamic (fluctuating) interference current or related proportional voltage (ordinate) versus the corresponding structure-to-electrolyte potentials at a selected location on the affected structure (abscissa).

BINDER
The nonvolatile portion of the vehicle of a formulated coating material.

BITUMINOUS COATING
An asphalt or coal-tar compound used to provide a protective coating for a surface.

BLAST ANGLE
(1) The angle of the blast nozzle with reference to the surface during abrasive blast cleaning. (2) The angle of the abrasive particles propelled from a centrifugal blasting wheel with reference to the surface being abrasive blast cleaned.

BLOWDOWN
(1) Injection of air or water under high pressure through a tube to the anode area for the purpose of purging the annular space and possibly correcting high resistance caused by gas blockage. (2) In conjunction with boilers or cooling towers, the process of discharging a significant portion of the aqueous solution in order to remove accumulated salts, deposits, and other impurities.

BLUSHING
Whitening and loss of gloss of a coating, usually organic, caused by moisture (also known as *blooming*).

BRACELET ANODES
Galvanic anodes with geometry suitable for direct attachment around the circumference of a pipeline. These may be half-shell bracelets consisting of two semi-circular sections or segmented bracelets consisting of a large number of individual anodes.

BRITTLE FRACTURE
Fracture with little or no plastic deformation.

BRUSH-OFF BLAST CLEANED SURFACE
A brush-off blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dirt, dust, loose mill scale, loose rust, and loose coating. Tightly adherent mill scale, rust, and coating may remain on the surface. Mill scale, rust, and coating are considered tightly adherent if they cannot be removed by lifting with a dull putty knife. [See NACE No. 4/SSPC-SP 7.]

CALCAREOUS COATING
A layer consisting of calcium carbonate and other salts deposited on the surface. When the surface is cathodically polarized as in cathodic protection, this layer is the result of the increased pH adjacent to the protected surface.

CALCAREOUS DEPOSIT
[See *Calcareous Coating*.]

CASE HARDENING
Hardening a ferrous alloy so that the outer portion, or case, is made substantially harder than the inner portion, or core. Typical processes are carburizing, cyaniding, carbo-nitriding, nitriding, induction hardening, and flame hardening.

CASEIN PAINT
Water-thinned paint with vehicle derived from milk.

CATALYST
A chemical substance, usually present in small amounts relative to the reactants, that increases the rate at which a chemical reaction (e.g., curing) would otherwise occur, but is not consumed in the reaction.

CATHODE
The electrode of an electrochemical cell at which reduction is the principal reaction. Electrons flow toward the cathode in the external circuit.

CATHODIC CORROSION
Corrosion resulting from a cathodic condition of a structure, usually caused by the reaction of an amphoteric metal with the alkaline products of electrolysis.

CATHODIC DISBONDMENT
The destruction of adhesion between a coating and the coated surface caused by products of a cathodic reaction.

CATHODIC INHIBITOR
A chemical substance that prevents or reduces the rate of the cathodic or reduction reaction.

CATHODIC POLARIZATION
The change of the electrode potential in the active (negative) direction caused by current across the electrode/electrolyte interface. [See *Polarization*.]

CATHODIC PROTECTION
A technique to reduce the corrosion of a metal surface by making that surface the cathode of an electrochemical cell.

CATHOLYTE
The electrolyte adjacent to the cathode of an electrochemical cell.

CATION
A positively charged ion that migrates through the electrolyte toward the cathode under the influence of a potential gradient.

CAVITATION
The formation and rapid collapse of cavities or bubbles within a liquid which often results in damage to a material at the solid/liquid interface under conditions of severe turbulent flow.

CELL
[See *Electrochemical Cell*.]

CEMENTATION
The introduction of one or more elements into the surface layer of a metal by diffusion at high temperature. (Examples of cementation include carburizing [introduction of carbon], nitriding [introduction of nitrogen], and chromizing [introduction of chromium].)

CHALKING
The development of loose, removable powder (pigment) at the surface of an organic coating, usually caused by weathering.

CHECKING
The development of slight breaks in a coating which do not penetrate to the underlying surface.

CHEMICAL CONVERSION COATING
An adherent reaction product layer on a metal surface formed by reaction with a suitable chemical to provide greater corrosion resistance to the metal and increase adhesion of coatings applied to the metal. (Example is an iron phosphate coating on steel, developed by reaction with phosphoric acid.)

CHEVRON PATTERN
A V-shaped pattern on a fatigue or brittle-fracture surface. The pattern can also be one of straight radial lines on cylindrical specimens.

CHLORIDE STRESS CORROSION CRACKING
Cracking of a metal under the combined action of tensile stress and corrosion in the presence of chlorides and an electrolyte (usually water).

COAT
One layer of a coating applied to a surface in a single continuous application to form a uniform film when dry.

COATING
A liquid, liquefiable, or mastic composition that, after application to a surface, is converted into a solid protective, decorative, or functional adherent film.

COATING SYSTEM
The complete number and types of coats applied to a substrate in a predetermined order. (When used in a broader sense, surface preparation, pretreatments, dry film thickness, and manner of application are included.)

COLD LAP
(1) Discontinuity caused by solidification of the meniscus of a partially cast anode as a result of interrupted flow of the casting stream. The solidified meniscus is covered with metal when the flow resumes. Cold laps can occur along the length of an anode. (2) A protective film consisting of one or more coats, applied in a predetermined order by prescribed methods to an as-specified dry film thickness, including any reinforcing material that may be specified.

COLD SHUT
Horizontal surface discontinuity caused by solidification of a portion of a meniscus during the progressive filling of a mold, which is later covered with more solidifying metal as the molten metal level rises. Cold shuts generally occur at corners remote from the point of pour.

COMMERCIAL BLAST CLEANED SURFACE
A commercial blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to no more than 33 percent of each unit area (approximately 58 cm^2 [9.0 $in.^2$]) of surface and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating. [See NACE No. 3/SSPC-SP 6.]

CONCENTRATION CELL
An electrochemical 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 cathodic and anodic regions.)

CONCENTRATION POLARIZATION
That portion of polarization of a cell produced by concentration changes resulting from passage of current though the electrolyte.

CONDUCTIVE COATING
(1) A coating that conducts electricity. (2) An electrically conductive, mastic-like material used as an impressed current anode on reinforced concrete surfaces.

CONDUCTIVE CONCRETE
A highly conductive cement-based mixture containing coarse and fine coke and other material used as an impressed current anode on reinforced concrete surfaces.

CONDUCTIVITY
(1) A measure of the ability of a material to conduct an electric charge. It is the reciprocal of resistivity. (2) The current transferred across a material (e.g., coating) per unit potential gradient.

CONTACT CORROSION
[See *Galvanic Corrosion.*]

CONTINUITY BOND
A connection, usually metallic, that provides electrical continuity between structures that can conduct electricity.

CONTINUOUS ANODE
A single anode with no electrical discontinuities.

CONVERSION COATING
[See *Chemical Conversion Coating*.]

CORROSION
The deterioration of a material, usually a metal, that results from a reaction with its environment.

CORROSION FATIGUE
Fatigue-type cracking of metal caused by repeated or fluctuating stresses in a corrosive environment characterized by shorter life than would be encountered as a result of either the repeated or fluctuating stress alone or the corrosive environment alone.

CORROSION INHIBITOR
A chemical substance or combination of substances that, when present in the environment, prevents or reduces corrosion.

CORROSION POTENTIAL (E_{corr})
The potential of a corroding surface in an electrolyte relative to a reference electrode under open-circuit conditions (also known as *rest potential, open-circuit potential*, or *freely corroding potential*).

CORROSION RATE
The rate at which corrosion proceeds.

CORROSION RESISTANCE
Ability of a material, usually a metal, to withstand corrosion in a given system.

CORROSIVENESS
The tendency of an environment to cause corrosion.

COUNTER ELECTRODE
[See *Auxiliary Electrode.*]

COUNTERPOISE
A conductor or system of conductors arranged beneath a power line, located on, above, or most frequently, below the surface of the earth and connected to the footings of the towers or poles supporting the power line.

COUPLE
[See *Galvanic Couple.*]

CRACKING (OF COATING)
Breaks in a coating that extend through to the substrate.

CRAZING
A network of checks or cracks appearing on the surface of a coating.

CREEP
Time-dependent strain occurring under stress.

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 of the metal to the surface of another material.

CRITICAL HUMIDITY
The relative humidity above which the atmospheric corrosion rate of some metals increases sharply.

CRITICAL PITTING POTENTIAL (E_p, E_{pp})
The lowest value of oxidizing potential (voltage) at which pits nucleate and grow. The value depends on the test method used.

CURING
Chemical process of developing the intended properties of a coating or other material (e.g., resin) over a period of time.

CURING AGENT
A chemical substance used for curing a coating or other material (e.g., resin). [Also referred to as *Hardener.*]

CURRENT
(1) A flow of electric charge. (2) The amount of electric charge flowing past a specified circuit point per unit time, measured in the direction of net transport of positive charges. (In a metallic conductor, this is the opposite direction of the electron flow.)

CURRENT DENSITY
The current to or from a unit area of an electrode surface.

CURRENT EFFICIENCY
The ratio of the electrochemical equivalent current density for a specific reaction to the total applied current density.

D

DC DECOUPLING DEVICE
A device used in electrical circuits that allows the flow of alternating current (AC) in both directions and stops or substantially reduces the flow of direct current (DC).

DEALLOYING
The selective corrosion of one or more components of a solid solution alloy (also known as *parting* or *selective dissolution*).

DECOMPOSITION POTENTIAL
The potential (voltage) on a metal surface necessary to decompose the electrolyte of an electrochemical cell or a component thereof.

DECOMPOSITION VOLTAGE
[See *Decomposition Potential.*]

DEEP GROUNDBED
One or more anodes installed vertically at a nominal depth of 15 m (50 ft) or more below the earth's surface in a drilled hole for the purpose of supplying cathodic protection.

DEPOLARIZATION
The removal of factors resisting the current in an electrochemical cell.

DEPOSIT ATTACK
Corrosion occurring under or around a discontinuous deposit on a metallic surface (also known as *poultice corrosion*).

DEZINCIFICATION
A corrosion phenomenon resulting in the selective removal of zinc from copper-zinc alloys. (This phenomenon is one of the more common forms of dealloying.)

DIELECTRIC COATING
A coating that does not conduct electricity.

DIELECTRIC SHIELD
An electrically nonconductive material, such as a coating, sheet or pipe, that is placed between an anode and an adjacent cathode, usually on the cathode, to improve current distribution in a cathodic protection system.

DIFFERENTIAL AERATION CELL
An electrochemical cell, the electromotive force of which is due to a difference in air (oxygen) concentration at one electrode as compared with that at another electrode of the same material.

DIFFUSION-LIMITED CURRENT DENSITY
The current density that corresponds to the maximum transfer rate that a particular species can sustain because of the limitation of diffusion (often referred to as *limiting current density*).

DISBONDMENT
The loss of adhesion between a coating and the substrate.

DISSIMILAR METALS
Different metals that could form an anode-cathode relationship in an electrolyte when connected by a metallic path.

DOUBLE LAYER
The interface between an electrode or a suspended particle and an electrolyte created by charge-charge interaction leading to an alignment of oppositely charged ions at the surface of the electrode or particle. The simplest model is represented by a parallel plate condenser.

DOUBLER PLATE
An additional plate or thickness of steel used to provide extra strength at the point of anode attachment to an offshore platform.

DRAINAGE
Conduction of electric current from an underground or submerged metallic structure by means of a metallic conductor.

DRIVING POTENTIAL
Difference in potential between the anode and the steel structure.

DRYING OIL
An oil capable of conversion from a liquid to a solid by slow reaction with oxygen in the air.

ELASTIC DEFORMATION
Changes of dimensions of a material upon the application of a stress within the elastic range. Following the release of an elastic stress, the material returns to its original dimensions without any permanent deformation.

ELASTIC LIMIT
The maximum stress to which a material may be subjected without retention of any permanent deformation after the stress is removed.

ELASTICITY
The property of a material that allows it to recover its original dimensions following deformation by a stress below its elastic limit.

ELECTRICAL INTERFERENCE
Any electrical disturbance on a metallic structure in contact with an electrolyte caused by stray current(s).

ELECTRICAL ISOLATION
The condition of being electrically separated from other metallic structures or the environment.

ELECTRO-OSMOSIS
The migration of water through a semipermeable membrane as a result of a potential difference caused by the flow of electric charge through the membrane.

ELECTROCHEMICAL CELL
A system consisting of an anode and a cathode immersed in an electrolyte so as to create an electrical circuit. The anode and cathode may be different metals or dissimilar areas on the same metal surface.

ELECTROCHEMICAL EQUIVALENT
The mass of an element or group of elements oxidized or reduced at 100% efficiency by the passage of a unit quantity of electricity.

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 other factors are kept constant. It is analogous to the chemical potential of a constituent except that it includes the electrical as well as chemical contributions to the free energy.

ELECTRODE
A conductor used to establish contact with an electrolyte and through which current is transferred to or from an electrolyte.

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 electrolyte or the external circuit. It represents the reversible work to move a unit of charge from the electrode surface through the electrolyte to the reference electrode.)

ELECTROKINETIC POTENTIAL
A potential difference in a solution caused by residual, unbalanced charge distribution in the adjoining solution, producing a double layer. The electrokinetic potential is different from the electrode potential in that it occurs exclusively in the solution phase. This potential represents the reversible work necessary to bring a unit charge from infinity in the solution up to the interface in question but not through the interface (also known as *zeta potential*).

ELECTROLYTE
A chemical substance containing ions that migrate in an electric field.

ELECTROLYTIC CLEANING
A process for removing soil, scale, or corrosion products from a metal surface by subjecting the metal as an electrode to an electric current in an electrolytic bath.

ELECTROMOTIVE FORCE 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.

ELLIPSOMETRY
An optical analytical technique employing plane-polarized light to study films.

EMBRITTLEMENT
Loss of ductility of a material resulting from a chemical or physical change.

EMF SERIES
[See *Electromotive Force Series.]*

ENAMEL
(1) A paint that dries to a hard, glossy surface. (2) A coating that is characterized by an ability to form a smooth, durable film.

END EFFECT
The more rapid loss of anode material at the end of an anode, compared with other surfaces of the anode, resulting from higher current density.

ENDURANCE LIMIT
The maximum stress that a material can withstand for an infinitely large number of fatigue cycles.

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

ENVIRONMENTAL CRACKING
Brittle fracture of a normally ductile material in which the corrosive effect of the environment is a causative factor.

Environmental cracking is a general term that includes all of the terms listed below. The definitions of these terms are listed elsewhere in the *Glossary:*
Corrosion Fatigue
Hydrogen Embrittlement
Hydrogen-Induced Cracking — (Stepwise Cracking)
Hydrogen Stress Cracking
Liquid Metal Cracking
Stress Corrosion Cracking
Sulfide Stress Cracking

The following terms have been used in the past in connection with environmental cracking but are now obsolete and should not be used:
Caustic Embrittlement
Delayed Cracking
Liquid Metal Embrittlement
Season Cracking
Static Fatigue
Sulfide Corrosion Cracking
Sulfide Stress Corrosion Cracking

EPOXY
Type of resin formed by the reaction of aliphatic or aromatic polyols (like bisphenol) with epichlorohydrin and characterized by the presence of reactive oxirane end groups.

EQUILIBRIUM POTENTIAL
The potential of an electrode in an electrolyte at which the forward rate of a given reaction is exactly equal to the reverse rate; the electrode potential with reference to a standard equilibrium, as defined by the Nernst equation.

EROSION
The progressive loss of material from a solid surface due to mechanical interaction between that surface and a fluid, a multicomponent fluid, or solid particles carried with the fluid.

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

EXCHANGE CURRENT
The rate at which either positive or negative charges are entering or leaving the surface when an electrode reaches dynamic equilibrium in an electrolyte.

EXFOLIATION CORROSION
Localized subsurface corrosion in zones parallel to the surface that result in thin layers of uncorroded metal resembling the pages of a book.

EXTERNAL CIRCUIT
The wires, connectors, measuring devices, current sources, etc., that are used to bring about or measure the desired electrical conditions within an electrochemical cell. It is this portion of the cell through which electrons travel.

FATIGUE
The phenomenon leading to fracture of a material under repeated or fluctuating stresses having a maximum value less than the tensile strength of the material.

FATIGUE STRENGTH
The maximum stress that can be sustained for a specified number of cycles without failure.

FAULT CURRENT
A current that flows from one conductor to ground or to another conductor due to an abnormal connection (including an arc) between the two. A fault current flowing to ground may be called a ground fault current.

FERRITE
The body-centered cubic crystalline phase of iron-based alloys.

FERRITIC STEEL
A steel whose microstructure at room temperature consists predominantly of ferrite.

FILIFORM CORROSION
Corrosion that occurs under a coating in the form of randomly distributed thread-like filaments.

FILM
A thin, not necessarily visible layer of material.

FINISH COAT
[See *Topcoat*.]

FORCED DRAINAGE
Drainage applied to underground or submerged metallic structures by means of an applied electromotive force or sacrificial anode.

FOREIGN STRUCTURE
Any metallic structure that is not intended as a part of a system under cathodic protection.

FOULING
An accumulation of deposits. This includes accumulation and growth of marine organisms on a submerged metal surface and the accumulation of deposits (usually inorganic) on heat exchanger tubing.

FRACTOGRAPHY
Descriptive treatment of fracture, especially in metals, with specific reference to photographs of the fracture surface.

FRACTURE MECHANICS
A quantitative analysis for evaluating structural reliability in terms of applied stress, crack length, and specimen geometry.

FREE MACHINING
The machining characteristics of an alloy to which an ingredient has been introduced to give small broken chips, lower power consumption, better surface finish, and longer tool life.

FRETTING CORROSION
Deterioration at the interface of

two contacting surfaces under load which is accelerated by their relative motion.

FURAN
Type of resin formed by the polymerization or polycondensation of furfuryl, furfuryl alcohol, or other compounds containing a furan ring.

GALVANIC ANODE
A metal that provides sacrificial protection to another metal that is more noble when electrically coupled in an electrolyte. This type of anode is the electron source in one type of cathodic protection.

GALVANIC CORROSION
Accelerated corrosion of a metal because of an electrical contact with a more noble metal or nonmetallic conductor in a corrosive electrolyte.

GALVANIC COUPLE
A pair of dissimilar conductors, commonly metals, in electrical contact in an electrolyte.

GALVANIC CURRENT
The electric current between metals or conductive nonmetals in a galvanic couple.

GALVANIC SERIES
A list of metals and alloys arranged according to their corrosion potentials in a given environment.

GALVANOSTATIC
Refers to an experimental technique whereby an electrode is maintained at a constant current in an electrolyte.

GENERAL CORROSION
Corrosion that is distributed more or less uniformly over the surface of a material.

GRAPHITIC CORROSION
Deterioration of gray cast iron in which the metallic constituents are selectively leached or converted to corrosion products, leaving the graphite intact.

GRAPHITIZATION
The formation of graphite in iron or steel, usually from decomposition of iron carbide at elevated temperatures. [Should not be used as a term to describe graphitic corrosion.]

GRIT
Small particles of hard material (e.g., iron, steel, or mineral) with irregular shapes that are commonly used as an abrasive in abrasive blast cleaning.

GRIT BLASTING
Abrasive blast cleaning using grit as the abrasive.

GROUNDBED
One or more anodes installed below the earth's surface for the purpose of supplying cathodic protection.

HALF-CELL
A pure metal in contact with a solution of known concentration of its own ion, at a specific temperature, develops a potential that is characteristic and reproducible; when coupled with another half-cell, an overall potential that is the sum of both half-cells develops.

HALF-CELL POTENTIAL
The potential in a given electrolyte of one electrode of a pair relative to a standard state or a reference state. Potentials can only be measured and expressed as the difference between the half-cell potentials of a pair of electrodes.

HAND TOOL CLEANING
Removal of loose rust, loose mill scale, and loose paint to degree specified, by hand chipping, scraping, sanding, and wire brushing. [See SSPC-SP 2.]

HARDENER
[See *Curing Agent*.]

HEAT-AFFECTED ZONE
That portion of the base metal that is not melted during brazing, cutting, or welding, but whose microstructure and properties are altered by the heat of these processes.

HEAT TREATMENT
Heating and cooling a solid metal or alloy in such a way as to obtain desired properties. Heating for the sole purpose of hot working is not considered heat treatment.

HIGH-PRESSURE WATER CLEANING
Water cleaning performed at pressures from 34 to 70 MPa (5,000 to 10,000 psig).

HIGH-PRESSURE WATER JETTING
Water jetting performed at pressures from 70 to 170 MPa (10,000 to 25,000 psig).

HIGH-TEMPERATURE HYDROGEN ATTACK
A loss of strength and ductility of steel by high-temperature reaction of absorbed hydrogen with carbides in the steel, resulting in decarburization and internal fissuring.

HOLIDAY
A discontinuity in a protective coating that exposes unprotected surface to the environment.

HYDROGEN BLISTERING
The formation of subsurface planar cavities, called hydrogen blisters, in a metal resulting from excessive internal hydrogen pressure. Growth of near-surface blisters in low-strength metals usually results in surface bulges.

HYDROGEN EMBRITTLEMENT
A loss of ductility of a metal resulting from absorption of hydrogen.

HYDROGEN-INDUCED CRACKING
Stepwise internal cracks that connect adjacent hydrogen blisters on different planes in the metal, or to the metal surface (also known as *stepwise cracking*).

HYDROGEN OVERVOLTAGE
Overvoltage associated with the liberation of hydrogen gas.

HYDROGEN STRESS CRACKING
Cracking that results from the presence of hydrogen in a metal in combination with tensile stress. It occurs most frequently with high-strength alloys.

IMPINGEMENT CORROSION
A form of erosion-corrosion generally associated with the local impingement of a high-velocity, flowing fluid against a solid surface.

IMPRESSED CURRENT
An electric current supplied by a device employing a power source that is external to the electrode system. (An example is direct current for cathodic protection.)

IMPRESSED CURRENT ANODE
An electrode, suitable for use as an anode when connected to a source of impressed current, which is generally composed of a substantially inert material that conducts by oxidation of the electrolyte and, for this reason, is not corroded appreciably.

IMPULSE DIELECTRIC TEST
A method of applying voltage to an insulated wire through the use of electric pulses (usually 170 to 250 pulses per second) to determine the integrity of the wire's insulation.

INCLUSION
A nonmetallic phase such as an oxide, sulfide, or silicate particle in a metal.

INORGANIC ZINC-RICH COATING
Coating containing a metallic zinc pigment (typically 75 wt% zinc or more in the dry film) in an inorganic vehicle.

INSTANT-OFF POTENTIAL
The polarized half-cell potential of an electrode taken immediately after the cathodic protection current is stopped, which closely approximates the potential without IR drop (i.e., the polarized potential) when the current was on.

INTERCRYSTALLINE CORROSION
[See *Intergranular Corrosion*.]

INTERDENDRITIC CORROSION
Corrosive attack of cast metals that progresses preferentially along paths between dendrites.

INTERFERENCE BOND
An intentional metallic connection, between metallic systems in contact with a common electrolyte, designed to control electrical current interchange between the systems.

INTERFERENCE CURRENT
[See *Stray Current*.]

INTERGRANULAR CORROSION
Preferential corrosion at or along the grain boundaries of a metal (also known as *intercrystalline*

corrosion).

INTERGRANULAR STRESS CORROSION CRACKING
Stress corrosion cracking in which the cracking occurs along grain boundaries.

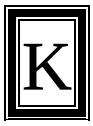
INTERNAL OXIDATION
The formation of isolated particles of oxidation products beneath the metal surface.

INTUMESCENCE
The swelling or bubbling of a coating usually caused by heating. [The term is commonly used in aerospace and fire-protection applications.]

ION
An electrically charged atom or group of atoms.

IR DROP
The voltage across a resistance in accordance with Ohm's Law.

IRON ROT
Deterioration of wood in contact with iron-based alloys.



KNIFE-LINE ATTACK
Intergranular corrosion of an alloy along a line adjoining or in contact with a weld after heating into the sensitization temperature range.

LAMELLAR CORROSION
[See *Exfoliation Corrosion*.]

LANGELIER INDEX
A calculated saturation index for calcium carbonate that is useful in predicting scaling behavior of natural water.

LINE CURRENT
The direct current flowing on a pipeline.

LINING
A coating or layer of sheet material adhered to or in intimate contact with the interior surface of a container used to protect the container against corrosion by its contents and/or to protect the contents of the container from contamination by the container material.

LIQUID METAL CRACKING
Cracking of a metal caused by contact with a liquid metal.

LONG-LINE CURRENT
Current though the earth between an anodic and a cathodic area that returns along an underground metallic structure.

LOW-CARBON STEEL
Steel having less than 0.30% carbon and no intentional alloying additions.

LOW-PRESSURE WATER CLEANING
Water cleaning performed at pressures less than 34 MPa (5,000 psig).

LUGGIN PROBE
A small tube or capillary filled with electrolyte, terminating close to the metal surface of an electrode under study, which is used to provide an ion-conducting path without diffusion between the electrode under study and a reference electrode.

MARTENSITE
A hard supersaturated solid solution of carbon in iron characterized by an acicular (needle-like) microstructure.

METAL DUSTING
The catastrophic deterioration of a metal exposed to a carbonaceous gas at elevated temperature.

METALLIZING
The coating of a surface with a thin metal layer by spraying, hot dipping, or vacuum deposition.

MILL SCALE
The oxide layer formed during hot fabrication or heat treatment of metals.

MIXED POTENTIAL
A potential resulting from two or more electrochemical reactions occurring simultaneously on one metal surface.

MODULUS OF ELASTICITY
A measure of the stiffness or rigidity of a material. It is actually the ratio of stress to strain in the elastic region of a material. If determined by a tension or compression test, it is also called Young's Modulus or the coefficient of elasticity.

NATURAL DRAINAGE
Drainage from an underground or submerged metallic structure to a more negative (more anodic) structure, such as the negative bus of a trolley substation.

NEAR-WHITE BLAST CLEANED SURFACE
A near-white blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. Random staining shall be limited to not more than 5% of each unit area of surface (approximately 58 cm^2 [9.0 $in.^2$]), and may consist of light shadows, slight streaks, or minor discolorations caused by stains of rust, stains of mill scale, or stains of previously applied coating. [See NACE No. 2/SSPC-SP 10.]

NEGATIVE RETURN
A point of connection between the cathodic protection negative cable and the protected structure.

NERNST EQUATION
An equation that expresses the exact electromotive force of an electrochemical cell in terms of the activities of products and reactants of the cell.

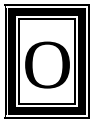
NERNST LAYER
The diffusion layer at the surface of an electrode in which the concentration of a chemical species is assumed to vary linearly from the value in the bulk solution to the value at the electrode surface.

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

NOBLE METAL
(1) A metal that occurs commonly in nature in the free state. (2) A metal or alloy whose corrosion products are formed with a small negative or a positive free-energy change.

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

NORMALIZING
Heating a ferrous alloy to a suitable temperature above the transformation range (austenitizing), holding at temperature for a suitable time, and then cooling in still air to a temperature substantially below the transformation range.



OPEN-CIRCUIT POTENTIAL
The potential of an electrode measured with respect to a reference electrode or another electrode in the absence of current.

ORGANIC ZINC-RICH COATING
Coating containing a metallic zinc pigment (typically 75 wt% zinc or more in the dry film) in an organic resin.

OVERVOLTAGE
The change in potential of an electrode from its equilibrium or steady-state value when current is applied.

OXIDATION
(1) Loss of electrons by a constituent of a chemical reaction. (2) Corrosion of a metal that is exposed to an oxidizing gas at elevated temperatures.

OXIDATION-REDUCTION POTENTIAL
The potential of a reversible oxidation-reduction electrode measured with respect to a reference electrode, corrected to the hydrogen electrode, in a given electrolyte.

OXYGEN CONCENTRATION CELL
[See *Differential Aeration Cell*.]

PAINT
A pigmented liquid or resin applied to a substrate as a thin layer that is converted to an opaque solid film after application. It is commonly used

as a decorative or protective coating.

PAINT SYSTEM
[See *Coating System.*]

PARTING
[See *Dealloying.*]

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

PASSIVATION POTENTIAL
[See *Primary Passive Potential.*]

PASSIVE
(1) The positive direction of electrode potential. (2) A state of a metal in which a surface reaction product causes a marked decrease in the corrosion rate relative to that in the absence of the product.

PASSIVE-ACTIVE CELL
An electrochemical cell, the electromotive force of which is caused by the potential difference between a metal in an active state and the same metal in a passive state.

PASSIVITY
The state of being passive.

PATINA
A thin layer of corrosion product, usually green, that forms on the surface of metals such as copper and copper-based alloys exposed to the atmosphere.

pH
The negative logarithm of the hydrogen ion activity written as:

$$pH = -\log_{10} (a_{H}^{+})$$

where a_{H}^{+} = hydrogen ion activity = the molar concentration of hydrogen ions multiplied by the mean ion-activity coefficient.

PICKLING
(1) Treating a metal in a chemical bath to remove scale and oxides (e.g., rust) from the surface. (2) Complete removal of rust and mill scale by acid pickling, duplex pickling, or electrolytic pickling. [See SSPC-SP 8.]

PICKLING SOLUTION
A chemical bath, usually an acid solution, used for pickling.

PIGMENT
A solid substance, generally in fine powder form, that is insoluble in the vehicle of a formulated coating material. It is used to impart color or other specific physical or chemical properties to the coating.

PIPE-TO-ELECTROLYTE POTENTIAL
[See *Structure-to-Electrolyte Potential.*]

PIPE-TO-SOIL POTENTIAL
[See *Structure-to-Electrolyte Potential.*]

PITTING
Localized corrosion of a metal surface that is confined to a small area and takes the form of cavities called pits.

PITTING FACTOR
The ratio of the depth of the deepest pit resulting from corrosion divided by the average penetration as calculated from mass loss.

PLASTIC DEFORMATION
Permanent deformation caused by stressing beyond the elastic limit.

PLASTICITY
The ability of a material to deform permanently (nonelastically) without fracturing.

POLARIZATION
The change from the open-circuit potential as a result of current across the electrode/electrolyte interface.

POLARIZATION ADMITTANCE
The reciprocal of polarization resistance.

POLARIZATION CELL
A DC decoupling device consisting of two or more pairs of inert metallic plates immersed in an aqueous electrolyte. The electrical characteristics of the polarization cell are high resistance to DC potentials and low impedance of AC.

POLARIZATION CURVE
A plot of current density versus electrode potential for a specific electrode/electrolyte combination.

POLARIZATION DECAY
The decrease in electrode potential with time resulting from the interruption of applied current.

POLARIZATION RESISTANCE
The slope (dE/di) at the corrosion potential of a potential (E)-current density (i) curve. (The measured slope is usually in good agreement with the true value of

the polarization resistance when the scan rate is low and any uncompensated resistance is small relative to the polarization resistance.)

POLARIZED POTENTIAL
The potential across the structure/electrolyte interface that is the sum of the corrosion potential and the cathodic polarization.

POLYESTER
Type of resin formed by the condensation of polybasic and monobasic acids with polyhydric alcohols.

POSTWELD HEAT TREATMENT
Heating and cooling a weldment in such a way as to obtain desired properties.

POTENTIAL-pH DIAGRAM
A graphical method of representing the regions of thermodynamic stability of species for metal/electrolyte systems (also known as *Pourbaix diagram*).

POTENTIODYNAMIC
Refers to a technique wherein the potential of an electrode with respect to a reference electrode is varied at a selected rate by application of a current through the electrolyte.

POTENTIOKINETIC
[See *Potentiodynamic.*]

POTENTIOSTAT
An instrument for automatically maintaining a constant electrode potential.

POTENTIOSTATIC
Refers to a technique for maintaining a constant electrode potential.

POT LIFE
The elapsed time within which a coating can be effectively applied after all components of the coating have been thoroughly mixed.

POULTICE CORROSION
[See *Deposit Attack.*]

POURBAIX DIAGRAM
[See *Potential-pH Diagram.*]

POWER TOOL CLEANING
Removal of loose rust, loose mill scale, and loose paint to degree specified by power tool chipping, descaling, sanding, wire brushing, and grinding. [See SSPC-SP 3.]

PRECIPITATION HARDENING
Hardening caused by the precipitation of a constituent from a supersaturated solid solution.

PRIMARY PASSIVE POTENTIAL
The potential corresponding to the maximum active current density (critical anodic current density) of an electrode that exhibits active-passive corrosion behavior.

PRIME COAT
[See *Primer.*]

PRIMER
A coating material intended to be applied as the first coat on an uncoated surface. The coating is specifically formulated to adhere to and protect the surface as well as to produce a suitable surface for subsequent coats. [Also referred to *as Prime Coat.*]

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

PROTECTIVE COATING
A coating applied to a surface to protect the substrate from corrosion.

REDUCTION
Gain of electrons by a constituent of a chemical reaction.

REFERENCE ELECTRODE
An electrode whose open-circuit potential is constant under similar conditions of measurement, which is used for measuring the relative potentials of other electrodes.

REFERENCE HALF-CELL
[See *Reference Electrode.*]

RELATIVE HUMIDITY
The ratio, expressed as a percentage, of the amount of water vapor present in a given volume of air at a given temperature to the amount required to saturate the air at that temperature.

REMOTE EARTH
A location on the earth far enough from the affected structure that the soil potential gradients associated with currents entering the earth from the affected structure are

insignificant.

RESISTIVITY
(1) The resistance per unit length of a substance with uniform cross section. (2) A measure of the ability of an electrolyte (e.g., soil) to resist the flow of electric charge (e.g., cathodic protection current). Resistivity data are used to design a groundbed for a cathodic protection system.

REST POTENTIAL
[See *Corrosion Potential*.]

REVERSIBLE POTENTIAL
[See *Equilibrium Potential*.]

RIMMED STEEL
An incompletely deoxidized steel. [Also called *Rimming Steel*.]

RISER
(1) That section of pipeline extending from the ocean floor up to an offshore platform. (2) The vertical tube in a steam generator convection bank that circulates water and steam upward.

RUST
Corrosion product consisting of various iron oxides and hydrated iron oxides. (This term properly applies only to iron and ferrous alloys.)

RUST BLOOM
Discoloration indicating the beginning of rusting.

S

SACKING
Scrubbing a mixture of a cement mortar over the concrete surface using a cement sack, gunny sack, or sponge rubber float.

SACRIFICIAL ANODE
[See *Galvanic Anode*.]

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).

SCALING
(1) The formation at high temperatures of thick corrosion-product layers on a metal surface. (2) The deposition of water-insoluble constituents on a metal surface.

SCANNING ELECTRON MICROSCOPE
An electron optical device that images topographical details with maximum contrast and depth of field by the detection, amplification, and display of secondary electrons.

SENSITIZING HEAT TREATMENT
A heat treatment, whether accidental, intentional, or incidental (as during welding), that causes precipitation of constituents (usually carbides) at grain boundaries, often causing the alloy to become susceptible to intergranular corrosion or intergranular stress corrosion cracking.

SHALLOW GROUNDBED
One or more anodes installed either vertically or horizontally at a nominal depth of less than 15 m (50 ft) for the purpose of supplying cathodic protection.

SHIELDING
(1) Protecting; protective cover against mechanical damage. (2) Preventing or diverting cathodic protection current from its natural path.

SHOP COAT
One or more coats applied in a shop or plant prior to shipment to the site of erection or fabrication.

SHOT BLASTING
Abrasive blast cleaning using metallic (usually steel) shot as the abrasive.

SHOT PEENING
Inducing compressive stresses in the surface layer of a material by bombarding it with a selected medium (usually steel shot) under controlled conditions.

SIGMA PHASE
An extremely brittle Fe-Cr phase that can form at elevated temperatures in Fe-Cr-Ni and Ni-Cr-Fe alloys.

SLIP
A deformation process involving shear motion of a specific set of crystallographic planes.

SLOW STRAIN RATE TECHNIQUE
An experimental technique for evaluating susceptibility to environmental cracking. It involves pulling the specimen to failure in uniaxial tension at a controlled slow strain rate while the specimen is in the test environment and examining the specimen for evidence of environmental cracking.

SLUSHING COMPOUND
Oil or grease coatings used to

provide temporary protection against atmospheric corrosion.

SOLUTION HEAT TREATMENT
Heating a metal to a suitable temperature and holding at that temperature long enough for one or more constituents to enter into solid solution, then cooling rapidly enough to retain the constituents in solution.

SOLVENT CLEANING
Removal of oil, grease, dirt, soil, salts, and contaminants by cleaning with solvent, vapor, alkali, emulsion, or steam. [See SSPC-SP 1.]

SPALLING
The spontaneous chipping, fragmentation, or separation of a surface or surface coating.

STANDARD ELECTRODE POTENTIAL
The reversible potential for an electrode process when all products and reactions are at unit activity on a scale in which the potential for the standard hydrogen reference electrode is zero.

STANDARD JETTING WATER
Water of sufficient purity and quality that it does not impose additional contaminants on the surface being cleaned and does not contain sediments or other impurities that are destructive to the proper functioning of water jetting equipment.

STEEL SHOT
Small particles of steel with spherical shape that are commonly used as an abrasive in abrasive blast cleaning or as a selected medium for shot peening.

STEP POTENTIAL
The potential difference between two points on the earth's surface separated by a distance of one human step, which is defined as one meter, determined in the direction of maximum potential gradient.

STEPWISE CRACKING
[See *Hydrogen-Induced Cracking*.]

STRAY CURRENT
Current through paths other than the intended circuit.

STRAY-CURRENT CORROSION
Corrosion resulting from current through paths other than the intended circuit, e.g., by any extraneous current in the earth.

STRESS CORROSION CRACKING
Cracking of a material produced by the combined action of corrosion and tensile stress (residual or applied).

STRESS RELIEVING (THERMAL)
Heating a metal to a suitable temperature, holding at that temperature long enough to reduce residual stresses, and then cooling slowly enough to minimize the development of new residual stresses.

STRUCTURE-TO-ELECTROLYTE POTENTIAL
The potential difference between the surface of a buried or submerged metallic structure and the electrolyte that is measured with reference to an electrode in contact with the electrolyte.

STRUCTURE-TO-SOIL POTENTIAL
[See *Structure-to-Electrolyte Potential*.]

STRUCTURE-TO-STRUCTURE POTENTIAL
The potential difference between metallic structures, or sections of the same structure, in a common electrolyte.

SUBSURFACE CORROSION
[See *Internal Oxidation*.]

SULFIDATION
The reaction of a metal or alloy with a sulfur-containing species to produce a sulfur compound that forms on or beneath the surface of the metal or alloy.

SULFIDE STRESS CRACKING
Cracking of a metal under the combined action of tensile stress and corrosion in the presence of water and hydrogen sulfide (a form of hydrogen stress cracking).

SURFACE POTENTIAL GRADIENT
Change in the potential on the surface of the ground with respect to distance.

T

TACK COAT
A thin wet coat applied to the surface that is allowed to dry just until it is tacky before application of a thicker wet coat. (Use of a tack coat allows application of thicker coats without sagging or runs.)

TAFEL PLOT
A plot of the relationship between the change in potential (E) and the logarithm of the current density (log *i*) of an electrode when it is polarized in both the anodic and cathodic directions from its open-circuit potential.

TAFEL SLOPE
The slope of the straight-line portion of the E log *i* curve on a Tafel plot. (The straight-line portion usually occurs at more than 50 mV from the open-circuit potential.)

TARNISH
Surface discoloration of a metal resulting from formation of a film of corrosion product.

THERMAL SPRAYING
A group of processes by which finely divided metallic or nonmetallic materials are deposited in a molten or semimolten condition to form a coating.

THERMOGALVANIC CORROSION
Corrosion resulting from an electrochemical cell caused by a thermal gradient.

THROWING POWER
The relationship between the current density at a point on a surface and its distance from the counterelectrode. The greater the ratio of the surface resistivity shown by the electrode reaction to the volume resistivity of the electrolyte, the better is the throwing power of the process.

TOPCOAT
The final coat of a coating system. [Also referred to as *Finish Coat*.]

TOUCH POTENTIAL
The potential difference between a metallic structure and a point on the earth's surface separated by a distance equal to the normal maximum horizontal reach of a human (approximately 1.0 m [3.3 ft]).

TRANSPASSIVE
The noble region of potential where an electrode exhibits a higher-than-passive current density.

TUBERCULATION
The formation of localized corrosion products scattered over the surface in the form of knob-like mounds called tubercles.

U-V-W

ULTIMATE STRENGTH
The maximum stress that a material can sustain.

ULTRAHIGH-PRESSURE WATER JETTING
Water jetting performed at pressures above 170 MPa (25,000 psig.)

UNDERFILM CORROSION
[See *Filiform Corrosion*.]

VEHICLE
The liquid portion of a formulated coating material.

VOID
(1) A holiday, hole, or skip in a coating. (2) A hole in a casting or weld deposit usually resulting from shrinkage during cooling.

WASH PRIMER
A thin, inhibiting primer, usually chromate pigmented, with a polyvinyl butyral binder.

WATER CLEANING
Use of pressurized water discharged from a nozzle to remove unwanted matter (e.g., dirt, scale, rust, coatings) from a surface.

WATER JETTING
Use of standard jetting water discharged from a nozzle at pressures of 70 MPa (10,000 psig) or greater to prepare a surface for coating or inspection.

WEIGHT COATING
An external coating applied to a pipeline to counteract buoyancy.

WHITE METAL BLAST CLEANED SURFACE
A white metal blast cleaned surface, when viewed without magnification, shall be free of all visible oil, grease, dust, dirt, mill scale, rust, coating, oxides, corrosion products, and other foreign matter. [See NACE No. 1/SSPC-SP 5.]

WELD DECAY
Intergranular corrosion, usually of

stainless steel or certain nickel-base alloys, that occurs as the result of sensitization in the heat-affected zone during the welding operation. [This is not a preferred term.]

WET FILM GAUGE
Device for measuring wet film thickness of a coating.

WORKING ELECTRODE
The test or specimen electrode in an electrochemical cell.

WROUGHT
Metal in the solid condition that is formed to a desired shape by working (rolling, extruding, forging, etc.), usually at an elevated temperature.

YIELD POINT
The stress on a material at which the first significant permanent or plastic deformation occurs without an increase in stress. In some materials, particularly annealed low-carbon steels, there is a well-defined yield point from the straight line defining the modulus of elasticity.

YIELD STRENGTH
The stress at which a material exhibits a specified deviation from the proportionality of stress to strain. The deviation is expressed in terms of strain by either the offset method (usually at a strain of 0.2%) or the total-extension-under-load method (usually at a strain of 0.5%.)