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Standard Terminology Relating to Corrosion and Corrosion Testing¹

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This standard has been approved for use by agencies of the Department of Defense.

1. Scope

1.1 This terminology covers commonly used terms in the field of corrosion. Related terms may be found in Terminologies D 16, D 4538, G 40, or other ASTM terminology standards. All terms defined by ASTM committees may be found in the *ASTM Dictionary of Engineering & Technology*.

2. Referenced Documents

2.1 ASTM Standards:²

D 16 Terminology for Paint, Related Coatings, Materials, and Applications

D 4538 Terminology Relating to Protective Coating and Lining Work for Power

G 40 Terminology Relating to Wear and Erosion

3. Terminology

AC impedance—See **electrochemical impedance**.

active—the negative direction of electrode potential. (Also used to describe corrosion and its associated potential range when an electrode potential is more negative than an adjacent depressed corrosion rate [passive] range.)

anion—a negatively charged ion.

anode—the electrode of an electrolytic cell at which oxidation is the principal reaction. (Electrons flow away from the anode in the external circuit. It is usually the electrode where corrosion occurs and metal ions enter solution.)

anode corrosion efficiency—the ratio of the actual corrosion (weight loss) of an anode to the theoretical corrosion (weight loss) calculated by Faraday's law from the quantity of electricity that has passed.

anodic inhibitor—a corrosion inhibitor whose primary action is to slow the kinetics of the anodic reaction, producing a positive shift in corrosion potential.

anodic polarization—the change of the electrode potential in the noble (positive) direction due to current flow. (See **polarization**.)

anodic protection—a technique to reduce the corrosion rate of a metal by polarizing it into its passive region where dissolution rates are low.

anolyte—the electrolyte adjacent to the anode of an electrolytic cell.

auxiliary electrode—See **counter electrode**.

breakdown potential—the least noble potential where pitting or crevice corrosion, or both, will initiate and propagate.

cathode—the electrode of an electrolytic cell at which reduction is the principal reaction. (Electrons flow toward the cathode in the external circuit.)

cathodic corrosion—corrosion of a metal when it is a cathode. (It usually happens to metals because of a rise in pH at the cathode or as a result of the formation of hydrides.)

cathodic inhibitor—a corrosion inhibitor whose primary action is to slow the kinetics of the cathodic reaction, producing a negative shift in corrosion potential.

cathodic polarization—the change of the electrode potential in the active (negative) direction due to current flow. (See **polarization**.)

cathodic protection—a technique to reduce the corrosion rate of a metal surface by making it the cathode of an electrochemical cell.

catholyte—the electrolyte adjacent to the cathode of an electrolytic cell.

cation—a positively charged ion.

caustic cracking—stress corrosion cracking of metals in caustic solutions. (See also **stress-corrosion cracking**.)

caustic embrittlement—See **caustic cracking**.

cavitation—the formation and rapid collapse within a liquid of cavities or bubbles that contain vapor or gas or both.

cavitation corrosion—the conjoint action of cavitation-erosion and corrosion.

cavitation damage—the degradation of a solid body resulting from its exposure to cavitation. (This may include loss of material, surface deformation, or changes in properties or appearance.)

cavitation-erosion—loss of material from a solid surface due to mechanical action of continuing exposure to cavitation.

¹ This terminology is under the jurisdiction of ASTM Committee G01 on Corrosion of Metals and are the direct responsibility of Subcommittee G01.02 on Terminology.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

chemical conversion coating—a protective or decorative nonmetallic coating produced *in situ* by chemical reaction of a metal with a chosen environment. (It is often used to prepare the surface prior to the application of an organic coating.)

concentration cell—an electrolytic cell, the emf 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—the chemical or electrochemical reaction between a material, usually a metal, and its environment that produces a deterioration of the material and its properties.

corrosion fatigue—the process in which a metal fractures prematurely under conditions of simultaneous corrosion and repeated cyclic loading at lower stress levels or fewer cycles than would be required in the absence of the corrosive environment.

corrosion fatigue strength—the maximum repeated stress that can be endured by a metal without failure under definite conditions of corrosion and fatigue and for a specific number of stress cycles and a specified period of time.

corrosion inhibitor—a chemical substance or combination of substances that, when present in the proper concentration and forms in the environment, prevents or reduces corrosion.

corrosion potential—the potential of a corroding surface in an electrolyte relative to a reference electrode measured under open-circuit conditions.

corrosion rate—the amount of corrosion occurring in unit time. (For example, mass change per unit area per unit time; penetration per unit time.)

counter electrode—the electrode in an electrochemical cell that is used to transfer current to or from a test electrode.

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.

critical anodic current density—the maximum anodic current density observed in the active region for a metal or alloy electrode that exhibits active-passive behavior in an environment.

critical humidity—the relative humidity above which the atmospheric corrosion rate of some metals increases sharply.

critical pitting potential—the least noble potential where pitting corrosion will initiate and propagate. (See breakdown potential.)

current density—the electric 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.

deactivation—the process of prior removal of the active corrosive constituents, usually oxygen, from a corrosive liquid by controlled corrosion of expendable metal or by other chemical means, thereby making the liquid less corrosive.

dealloying—See **parting**.

depolarization—not a preferred term. (See **polarization**.)

deposit corrosion—localized corrosion under or around a deposit or collection of material on a metal surface. (See also **crevice corrosion**.)

dezincification—See **parting**; specific to copper-zinc alloys.

differential aeration cell (oxygen concentration cell)—a concentration cell caused by differences in oxygen concentration along the surface of a metal in an electrolyte. (See **concentration cell**.)

diffusion limited current density—the current density, often referred to as limiting current density, that corresponds to the maximum transfer rate that a particular species can sustain due to the limitation of diffusion.

electrochemical admittance—the reciprocal of the electrochemical impedance, $\Delta I/\Delta E$.

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 impedance—the frequency dependent, complex valued proportionality factor, $\Delta E/\Delta I$, between the applied potential (or current) and the response current (or potential) in an electrochemical cell. This factor becomes the impedance when the perturbation and response are related linearly (the factor value is independent of the perturbation magnitude) and the response is caused only by the perturbation. The value may be related to the corrosion rate when the measurement is made at the corrosion potential.

electrochemical noise—fluctuations of potential or current, or both, originating from uncontrolled variations in a corrosion process.

electrochemical potential (electrochemical tension)—the partial derivative of the total electrochemical free energy of the system with respect to the number of moles of the constituent in a solution when all other factors are constant. (Analogous to the chemical potential of the constituent except that it includes the electrical as well as the chemical contributions to the free energy.)

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.)

electrolysis—production of chemical changes of the electrolyte by the passage of current through an electrochemical cell.

electrolytic cleaning—a process of removing soil, scale, or corrosion products from a metal surface by subjecting it as an electrode to an electric current in an electrolytic bath.

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.

embrittlement—the severe loss of ductility or toughness or