Glossary

acid A compound that yields hydrogen ions (H^+) when dissolved in water.

alkaline 1. Having properties of an alkali. 2. Having a pH greater than 7.

alloy steel Steel containing specified quantities of alloying elements added to effect changes in mechanical or physical properties.

amphoteric Capable of reacting chemically either as an acid or a base. In reference to certain metals, signifies their propensity to corrode at both high and low pH.

anode In a corrosion cell, the area over which corrosion occurs and metal ions enter solution; oxidation is the principal reaction.

attemperator Apparatus for reducing and controlling the temperature of a superheated steam.

austenite A face-centered cubic solid solution of carbon or other elements in nonmagnetic iron.

austenitic stainless steel A nonmagnetic stainless steel possessing a microstructure of austenite. In addition to chromium, these steels commonly contain at least 8% nickel.

backing In welding, a material placed under or behind a joint to enhance the quality of the weld at the root. The backing may be a metal ring or strip; a pass of weld metal; or a nonmetal such as carbon, granular flux, or a protective gas.

base metal 1. In welding, the metal to be welded. 2. After welding, that part of the metal that was not melted.

black liquor The liquid material remaining from pulpwood cooking in the soda or sulfate papermaking process.

blowdown In connection with boilers, the process of discharging a significant portion of the aqueous solution in order to remove accumulated salts, deposits, and other impurities.

brittle fracture Separation of a solid accompanied by little or no macroscopic plastic deformation.

cathode In a corrosion cell, the area over which reduction is the principal reaction. It is usually an area that is not attacked.

caustic cracking A form of stress-corrosion cracking affecting carbon steels and

austenitic stainless steels (300 series) when exposed to concentrated caustic — i.e., highly alkaline — solutions.

caustic embrittlement An obsolete historical term denoting a form of stress-corrosion cracking most frequently encountered in carbon steels or iron–chromium–nickel alloys that are exposed to concentrated hydroxide solutions at temperatures of 200 to 250°C (400 to 480°F).

cavitation The formation and instantaneous collapse of innumerable tiny voids or cavities within a liquid subjected to rapid and intense pressure changes.

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.

cementite A compound of iron and carbon, known chemically as iron carbide and having the approximate chemical formula Fe_3C.

chelating agent An organic compound in which atoms form more than one coordinate bond with metals in solution.

cold work Permanent deformation of a metal produced by an external force.

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 — fracture occurs at lower stress levels or fewer cycles than would be required in the absence of the corrosive environment.

corrosion product Substance formed as a result of corrosion.

creep Time-dependent deformation occurring under stress and high temperature.

creep rupture See **stress rupture.**

dealloying (see also **selective leaching**) The selective corrosion of one or more components of a solid solution alloy. Also called *parting* or *selective leaching.*

denickelification Corrosion in which nickel is selectively leached from nickel-containing alloys. Most commonly observed in copper–nickel alloys after extended service in fresh water.

dezincification Corrosion in which zinc is selectively leached from zinc-containing alloys. Most commonly found in copper–zinc alloys containing less than 85% copper after extended service in water containing dissolved oxygen.

downcomer Boiler tubes in which fluid flow is away from the steam drum.

ductile fracture Fracture characterized by tearing of metal accompanied by appreciable gross plastic deformation and expenditure of considerable energy.

ductility The ability of a material to deform plastically without fracturing.

economizer A heat-exchange device for increasing feedwater temperature by recovery of heat from gases leaving the boiler.

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.

eutectic structure The microstructure resulting from the freezing of liquid metal such that two or more distinct, solid phases are formed.

exfoliation A type of corrosion that progresses approximately parallel to the outer surface of the metal, causing layers of the metal or its oxide to be elevated by the formation of corrosion products.

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 continued use.

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

ferrite Designation commonly assigned to alpha iron containing elements in solid solution.

ferritic stainless steel A magnetic stainless steel possessing a microstructure of alpha ferrite. Its chromium content varies from 11.5 to 27%, but it contains no nickel.

fish-mouth rupture A thin- or thick-lipped burst in a boiler tube that resembles the open mouth of a fish.

flux (noun) 1. A substance, often a liquid, that is capable of dissolving metal oxides. 2. The rate of transfer of fluid, particles, or energy across a given surface.

gas porosity Fine holes or pores within a metal that are caused by entrapped gas or by evolution of dissolved gas during solidification.

grain An individual crystal in a polycrystalline metal or alloy.

grain boundary A narrow zone in a metal corresponding to the transition from one crystallographic orientation to another, thus separating one grain from another.

graphitic corrosion Corrosion of gray iron in which the iron matrix is selectively leached away, leaving a porous mass of graphite behind. Graphitic corrosion occurs in relatively mild aqueous solutions and on buried pipe fittings.

graphitization A metallurgical term describing the formation of graphite in iron or steel, usually from decomposition of iron carbide at elevated temperatures. Not recommended as a term to describe graphitic corrosion.

gulping Intermittent, brief passage of water from the steam drum of a boiler into the superheater caused by variable water levels.

heat-affected zone In welding, that portion of the base metal that was not melted during welding, but whose microstructure and mechanical properties were altered by the heat.

hematite A magnetic form of iron oxide, Fe_2O_3. Hematite is gray to bright red. The reddish forms are nonprotective, and their occurrence indicates the presence of high levels of oxygen.

hydrolysis A chemical process of decomposition involving splitting of a bond and addition of the elements of water.

inclusions Particles of foreign material in a metallic matrix. The particles are usually compounds (such as oxides, sulfides or silicates), but may be any substance that is foreign to (and essentially insoluble in) the matrix.

intergranular Occurring between crystals or grains. Also, *intercrystalline.*

intergranular corrosion Corrosion occurring preferentially at grain boundaries, usually with slight or negligible attack on the adjacent grains.

laning The intentional or unintentional formation of a bypass or short circuit for furnace gases resulting in redistribution of heat-transfer rates.

lap A surface imperfection having the appearance of a seam, and caused by hot metal, fins, or sharp corners being folded over and then being rolled or forged into the surface without being welded.

magnetite A magnetic form of iron oxide, Fe_3O_4. Magnetite is dark gray to black, and forms a protective film on iron surfaces.

martensite A supersaturated solid solution of carbon in iron characterized by a needlelike microstructure.

matrix The principal phase in which another constituent is embedded.

microstructure The structure of a metal as revealed by microscopic examination of the etched surface of a polished specimen.

mild steel Carbon steel having a maximum carbon content of approximately 0.25%.

overheating Heating of a metal or alloy to such a high temperature that its properties are impaired.

pearlite A microstructural aggregate consisting of alternate lamellae of ferrite and cementite.

penetration In welding, the distance from the original surface of the base metal to that point at which fusion ceased.

pH 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 indicate increasing basicity.

pipe The central cavity formed by contraction in metal, especially ingots, during solidification.

pitting The formation of small, sharp cavities in a metal surface by corrosion.

plain carbon steel Steel containing carbon up to about 2% and only residual quantities of other elements except those added for deoxidation. Also called *ordinary steel.*

residual stress Stresses that remain within a body as a result of plastic deformation.

riser Boiler tubes in which fluid flow is toward the steam drum.

root crack A crack in either a weld or the heat-affected zone at the root of a weld.

root of joint In welding, the portion of a weld joint where the members are closest to each other before welding. In cross section, this may be a point, a line, or an area.

root of weld The points at which the weld bead intersects the base-metal surfaces either nearest to or coincident with the root of joint.

scaling The formation at high temperatures of thick layers of corrosion product on a metal surface.

scaling temperature A temperature or range of temperatures at which the resistance of a metal to thermal corrosion breaks down.

seam On a metal surface, an unwelded fold or lap that appears as a crack, usually resulting from a discontinuity.

seam welding Making a longitudinal weld in sheet metal or tubing.

selective leaching Corrosion in which one element is preferentially removed from an alloy, leaving a residue (often porous) of the elements that are more resistant to the particular environment.

spalling The cracking and flaking of particles out of a surface.

stainless steel Any of several steels containing 12 to 30% chromium as the principal alloying element; they usually exhibit passivity in aqueous environments.

stoker-chain grate A device for conveying solid fuel across a furnace such that the grate acts as a burning platform.

stress Force per unit area, often thought of as force acting through a small area within a plane. Stress can be divided into components, normal and parallel to the plane, called *normal stress* and *shear stress*, respectively. *True stress* denotes the stress where force and area are measured at the same time. *Conventional stress*, as applied to tension and compression tests, is force divided by original area.

stress-corrosion cracking Failure by cracking under combined action of corrosion and stress, either external (applied) stress or internal (residual) stress. Cracking may be either intergranular or transgranular, depending on the metal and the corrosive medium.

stress raisers Changes in contour or discontinuities in structure that cause local increases in stress.

stress rupture (creep rupture) A fracture that results from creep.

synergism Cooperative action of discrete agencies such that the total effect is greater than the sum of the effects taken independently.

tensile strength In tensile testing, the ratio of maximum load to original cross-sectional area. Also called *ultimate strength.*

thermal fatigue The process leading to fracture under repeated or fluctuating

thermally induced stresses having a maximum value less than the tensile strength of the material.

transgranular Occurring through or across crystals or grains. Also, *intracrystalline* or *transcrystalline.*

tuberculation The formation of localized corrosion products in the form of knob-like mounds called *tubercles.*

ultrasonic testing A nondestructive test in which an ultrasonic beam is applied to sound-conductive materials having elastic properties; the test is used to locate inhomogeneities or structural discontinuities within the material.

underbead crack A subsurface crack in the base metal near a weld.

undercut In weldments, a groove melted into the base metal adjacent to the toe of a weld and left unfilled.

weld A union made by welding.

weld bead A deposit of filler metal from a single welding pass.

welding current The current flowing through a welding circuit during the making of a weld.

weldment An assembly whose component parts are joined by welding.

weld metal That portion of a weld that has been melted during welding.

Further Reading

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