

Corrosion Glossary

calcareous coating or deposit

A layer consisting of a mixture of calcium carbonate and magnesium hydroxide deposited on surfaces being cathodically protected because of the increased pH adjacent to the protected surface.

calomel electrode

An *electrode* widely used as a reference electrode of known potential in electrometric measurement of acidity and alkalinity, corrosion studies, voltammetry, and measurement of the potentials of other electrodes. See also *electrode potential*, *reference electrode*, and *saturated calomel electrode*.

calorizing

Imparting resistance to oxidation to an iron or steel surface by heating in aluminum powder at 800 to 1000 °C (1470 to 1830 °F).

carbonitriding

A *case hardening* process in which a suitable ferrous material is heated above the lower transformation temperature in a gaseous atmosphere of such composition as to cause simultaneous absorption of carbon and nitrogen by the surface and, by diffusion, create a concentration gradient. The process is completed by cooling at a rate that produces the desired properties in the workpiece.

carburizing

The absorption of carbon atoms by a metal at high temperatures; it may remain dissolved, or form metal carbides; Absorption and diffusion of carbon into solid ferrous alloys by heating, to a temperature usually above A_c in contact with a suitable carbonaceous material. A form of *case hardening* that produces a carbon gradient extending inward from the surface, enabling the surface layer to be hardened either by quenching directly from the carburizing temperature or by cooling to room temperature then re-austenitizing and quenching.

Carburization

The absorption of carbon into a metal surface; may or may not be desirable.

case hardening

A generic term covering several processes applicable to steel that change the chemical composition of the surface layer by absorption of carbon, nitrogen, or a mixture of the two and, by diffusion, create a concentration gradient. The outer portion, or case, is made

clad metal

A composite metal containing, two or more layers that have been bonded together. The bonding may have been accomplished by co-rolling, co-extrusion, welding, diffusion bonding, casting, heavy chemical deposition, heavy electroplating, or explosive cladding.

cleavage

Splitting (fracture) of a crystal on a crystallographic plane of low index.

cleavage fracture

A fracture, usually of polycrystalline metal, in which most of the grains have failed by *cleavage*, resulting in bright reflecting facets. It is associated with low-energy *brittle fracture*.

cold cracking

A type of weld cracking that usually occurs below 203 °C (400 °F). Cracking may occur during or after cooling to room temperature, sometimes with a considerable time delay. Three factors combine to produce cold cracks: stress (for example, from thermal expansion and contraction), hydrogen (from hydrogen-containing welding consumables), and a susceptible microstructure (plate martensite is most susceptible to cracking, ferritic and bainitic structures least susceptible). See also *hot cracking*, *lamellar tearing* and *stress-relief cracking*.

cold working

Deforming metal plastically under conditions of temperature and strain rate that induce strain hardening. Usually, but not necessarily, conducted at room temperature. Contrast with *hot working*.

combined carbon

The part of the total carbon in steel or cast iron that is present as other than *free carbon*.

complexation

The formation of complex chemical species by the coordination of groups of atoms termed ligands to a central ion, commonly a metal ion. Generally, the ligand coordinates by providing a pair of electrons that forms an ionic or covalent bond to the central ion. See also *chelate*, *coordination compound*, and *ligand*.

compressive

Pertaining to forces on a body or part of a body that tend to crush or compress the body.

compressive strength

The maximum compressive *stress* a material is capable of developing. With a brittle material that fails in

- substantially harder than the inner portion, or core. The processes commonly used are carburizing and quench hardening; cyaniding; nitrifying; and carbonitriding. The use of the applicable specific process name is preferred.
- CASS test**
See *copper-accelerated salt-spray test*.
- 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 taking up electrons and being discharged, oxygen being reduced, and the reduction of an element or group of elements from a high Cl a lower valence state. Contrast with *anode*.
- cathode efficiency**
Current efficiency at the *cathode*.
- cathode film**
The portion of solution in immediate contact with the *cathode* during *electrolysis*.
- cathodic cleaning**
Electrolytic cleaning in which the work is the *cathode*.
- 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 its substrate by products of a *cathodic reaction*.
- cathodic inhibitor**
A chemical substance or mixture that prevents or reduces the rate of the cathodic or reduction reaction by physical, physico-chemical or chemical action.
- cathodic pickling**
Electrolytic pickling in which the work is the *cathode*.
- cathodic polarization**
Polarization of the cathode; change of the *electrode potential* in the active (negative) direction due to current flow; a reduction from the initial potential resulting from current flow effects at or near the cathode surface. Potential becomes more active (negative) because of cathodic polarization. See also *polarization*.
- 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
- compression by fracturing, the compressive strength has a definite value. In the case of ductile, malleable, or semiviscous materials (which do not fail in compression by a shattering fracture), the value obtained for compressive strength is an arbitrary value dependent on the degree of distortion that is regarded as effective failure of the material.
- compressive stress**
A stress that causes an elastic body to deform (shorten) in the direction of the applied load. Contrast with *tensile stress*.
- 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.
- concentration polarization**
That portion of the *polarization* of a cell produced by concentration changes resulting from passage of current through the electrolyte.
- conductivity**
The ratio of the electric current density to the electric field in a material. Also called electrical conductivity or specific conductance.
- contact corrosion**
A term primarily used in Europe to describe *galvanic corrosion* between dissimilar metals.
- contact plating**
A metal plating process wherein the plating current is provided by galvanic action between the work metal and a second metal, without the use of an external source of current.
- contact potential**
The potential difference at the junction of two dissimilar substances.
- continuity bond**
A metallic connection that provides electrical continuity between metal structures.
- conversion coating**
A coating consisting of a compound of the surface metal, produced by chemical or electrochemical treatments of the metal. Examples include chromate coatings on zinc, cadmium, magnesium, and aluminum and oxide and phosphate coatings on steel. See also *chromate treatment* and *phosphating*.
- coordination compound**
A compound with a central atom or ion bound to a group of ions or molecules surrounding it. Also called coordination complex. See also *chelate*, *complexation*, and *ligand*.
- copper-accelerated salt-spray (CASS) test**
An *accelerated corrosion test* for some electrodeposits for anodic coatings on aluminum.
- corrodokote test**
An *accelerated corrosion test* for electrodeposits.

	electronic to the ionic conductor. A cathodic reaction is a reduction process. An example common in corrosion is: $Ox + ne \rightarrow Red$.		
catholyte	The <i>electrolyte</i> adjacent to the cathode of an electrolytic cell.	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.
cation	A positively charged ion that migrates through the electrolyte toward the <i>cathode</i> under the influence of a potential gradient. See also <i>anion</i> and <i>ion</i> .	corrosion effect	A change in any part of the corrosion system caused by <i>corrosion</i> .
caustic	(1) Burning or corrosive. (2) A hydroxide of a light metal, such as sodium hydroxide or potassium hydroxide.	corrosion embrittlement	The severe loss of ductility of a metal resulting from corrosive attack, usually <i>intergranular</i> and often not visually apparent.
caustic dip	A strongly alkaline solution into which metal is immersed for etching, for neutralizing acid, or for removing organic materials such as greases or paints.	corrosion-erosion	Corrosion which is increased because of the abrasive action of a moving stream; the presence of suspended particles greatly accelerates abrasive action. See <i>erosion-corrosion</i> .
caustic embrittlement	An obsolete historical term denoting a form of <i>stress-corrosion cracking</i> 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).	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.
cavitation	The formation and instantaneous collapse of innumerable tiny voids or cavities within a liquid subjected to rapid and intense pressure changes. Cavitation produced by ultrasonic radiation is sometimes used to effect violent localized agitation. Cavitation caused by severe turbulent flow often leads to <i>cavitation damage</i> .	Corrosion Fatigue Limit	The maximum cyclic stress value that a metal can withstand for a specified number of cycles or length of time in a given corrosive environment. See <i>corrosion fatigue strength</i> .
cavitation corrosion	A process involving conjoint <i>corrosion</i> and <i>cavitation</i> .	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.
cavitation damage	The degradation of a solid body resulting from its exposure to <i>cavitation</i> . This may include loss of material, surface deformation, or changes in properties or appearance.	corrosion inhibitor	See <i>inhibitor</i> .
cavitation-erosion	Progressive loss of original material from a solid surface due to continuing exposure to <i>cavitation</i> .	corrosion potential (E_{corr})	The <i>potential</i> of a corroding surface in an electrolyte, relative to a <i>reference electrode</i> . Also called rest potential, open circuit potential, or freely corroding potential.
cell	Electrochemical system consisting of an <i>anode</i> and a <i>cathode</i> immersed in an <i>electrolyte</i> . 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 <i>electrochemical cell</i> .	corrosion product	Substance formed as a result of <i>corrosion</i> .
Cementation Coating	A coating developed on a metal surface by a high temperature diffusion process (as carburization, coloring, or chromizing).	corrosion protection	Modification of a <i>corrosion system</i> so that corrosion damage is mitigated.
cementite	A compound of iron and carbon, known chemically as iron carbide and having the approximate	corrosion rate	<i>Corrosion effect</i> 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 ² /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

	chemical formula Fe ₃ C. It is characterized by an orthorhombic crystal structure. When it occurs as a phase in steel, the chemical composition will be altered by the presence of manganese and other carbide-forming elements.	should be accompanied by information on the type, time dependency, and location of the corrosion effect.
chalking	The development of loose removable powder at the surface of an organic coating usually caused by weathering.	corrosion resistance Ability of a metal to withstand <i>corrosion</i> in a given <i>corrosion system</i> .
checking	The development of slight breaks in a coating that do not penetrate to the underlying surface.	corrosion system System consisting of one or more metals and all parts of the environment that influence <i>corrosion</i> .
checks	Numerous, very fine cracks in a coating or at the surface of a metal part. Checks may appear during processing or during service and are most often associated with thermal treatment or thermal cycling. Also called check marks. <i>checking</i> , or <i>heat checks</i> .	corrosivity Tendency of an environment to cause <i>corrosion</i> in a given <i>corrosion system</i> .
chelate	(1) A molecular structure in which a heterocyclic ring can be formed by the unshared electrons of neighboring atoms. (2) A <i>coordination compound</i> in which a heterocyclic ring is formed by a metal bound to two atoms of the associated <i>ligand</i> . See also <i>complexation</i> .	counter electrode See <i>auxiliary electrode</i> .
chelating agent	(1) An organic compound in which atoms form more than one coordinate bond with metals in solution. (2) A substance used in metal finishing to control or eliminate certain metallic ions present in undesirable quantities.	couple A cell developed in an electrolyte resulting from electrical contact between two dissimilar metals. See <i>galvanic corrosion</i> .
chelation	A chemical process involving formation of a heterocyclic ring compound that contains at least one metal cation or hydrogen ion in the ring.	covering power The ability of a solution to give satisfactory plating at very low current densities. a condition that exists in recesses and pits. This term suggests an ability to cover, but not necessarily to build up, a uniform coating, whereas <i>throwing power</i> suggests the ability to obtain a coating of uniform thickness of an irregularly shaped object.
chemical conversion coating	A protective or decorative nonmetallic coating produced <i>in situ</i> 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.	cracking (of coating) Breaks in a coating that extend through to the underlying surface.
chemical potential	In a thermodynamic system of several constituents, the rate of change of the Gibbs function of the system with respect to the change in the number of moles of a particular constituent.	crazing A network of checks or cracks appearing on the surface.
chemical vapor deposition	A coating process, similar to gas carburizing and carbonitriding, whereby a reactant atmosphere gas is fed into a processing chamber where it decomposes at the surface of the workpiece, liberating one material for either absorption by, or accumulation on the workpiece. A second material is liberated in gas form and is removed from the processing chamber, along with	creep Time-dependent strain occurring under stress. The creep strain occurring at a diminishing rate is called primary creep; that occurring at a minimum and almost constant rate, secondary creep; and that occurring at an accelerating rate, tertiary creep.
		creep-rupture embrittlement <i>Embrittlement</i> under creep conditions of, for example, aluminum alloys and steels that results in abnormally low rupture ductility. In aluminum alloys, iron in amounts above the solubility limit is known to cause such embrittlement; in steels, the phenomenon is related to the amount of impurities (for example, phosphorus, sulfur, copper, arsenic, antimony, and tin) present. In either case, failure occurs by <i>intergranular cracking</i> of the embrittled material.
		creep-rupture strength The stress that will cause fracture in a creep test at a given time in a specified constant environment. Also called stress-rupture strength.
		crevice corrosion <i>Localized corrosion</i> 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

	excess atmosphere gas.		the metal and the surface of another material.
chemisorption	The binding of an adsorbate to the surface of a solid by forces whose energy levels approximate those of a chemical bond. Contrast with <i>physisorption</i> .	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.
chevron pattern	A fractographic pattern of radial marks (shear ledges) that look like nested letters "V"; sometimes called a herringbone pattern. Chevron patterns are typically found on <i>brittle fracture</i> surfaces in parts whose widths are considerably greater than their thicknesses. The points of the chevrons can be traced back to the fracture origin.	critical flaw size	The size of a flaw (defect) in a structure that will cause failure at a particular stress level.
chromadizing	Improving paint adhesion on aluminum or aluminum alloys, mainly aircraft skins, by treatment with a solution of chromic acid. Also called chromodizing or chromatizing. Not to be confused with chromating or chromizing.	critical humidity	The <i>relative humidity</i> above which the atmospheric corrosion rate of some metals increases sharply.
chromate treatment	A treatment of metal in a solution of a hexavalent chromium compound to produce a conversion coating consisting of trivalent and hexavalent chromium compounds.	critical pitting potential (E_{cp}, E_p, E_{pp})	The lowest value of oxidizing potential at which pits nucleate and grow. It is dependent on the test method used.
chromating	Performing a <i>chromate treatment</i> .	current	The net transfer of electric charge per unit time. Also called electric current. See also <i>current density</i> .
chrome pickle	(1) Producing a chromate conversion coating on magnesium for temporary protection or for a paint base. (2) The solution that produces the conversion coating.	current density	The current flowing to or from a unit area of an electrode surface, generally expressed as amps per sq ft or milliamperes per sq ft (also milliamps per sq cm, etc).
chromizing	A surface treatment at elevated temperature, generally carried out in pack, vapor, or salt bath, in which an alloy is formed by the inward diffusion of chromium into the base metal.	current efficiency	The ratio of the electrochemical equivalent current density for a specific reaction to the total applied current density.