

Common Types of Corrosion

Galvanic Corrosion

Galvanic corrosion results from the electrochemical reaction that occurs in the presence of an electrolyte when two dissimilar metals are in contact. The strength of the reaction—and the extent of the corrosion—depend on a number of factors, including the conductivity of the electrolyte and potential difference of the metals.

The metal with less resistance becomes anodic and more subject to corrosion, while the more resistant becomes cathodic.

The Galvanic Series Table, developed through laboratory tests on industrial metal alloys in sea water (a powerful electrolyte), list metals according to their relative resistance to galvanic corrosion. Those less resistant to galvanic corrosion (anodic) are at the top, and those more resistant (cathodic) are at the bottom.

The metals grouped together are subject to only slight galvanic effect when in contact, and metals at the top will suffer galvanic corrosion when in contact with metals at the bottom (in the presence of an electrolyte). The farther apart two metals are on the table, the greater the potential corrosion.

Galvanic Series Table	
Anodic End	
Magnesium	Type 304 stainless steel (active)
Magnesium alloys	Type 316 stainless steel (active)
Zinc	Lead
Galvanized steel	Tin
Naval brass (C46400)	
Aluminum 5052H	Muntz metal (C28000)
Aluminum 3004	Manganese bronze (C67500)
Aluminum 3003	
Aluminum 1100	Nickel (active)
Aluminum 6053	Inconel (active)
Alclad aluminum alloys	
Aluminum bronze (C61400)	Cartridge brass (C26000)
Cadmium	Admiralty metal (C44300)
Copper (C11000)	
Aluminum 2017	Red brass (C23000)
Aluminum 2024	
	Silicon bronze (C 65100)
Low-carbon steel	Copper nickel, 30% (C71500)
Wrought iron	
Cast iron	Nickel (passive)
Monel	Inconel (passive)
Ni-resist	
Type 304 stainless steel (passive)	Gold
Type 410 stainless steel (passive)	
Type 316 stainless steel (active)	Platinum
50Pb-50Sn solder	
Silver	Cathodic End

Common Types of Corrosion (cont'd)

Pitting

Pitting corrosion is localized and is identified by a cavity with a depth equal to or greater than the cavity's surface diameter. Pits may have different sizes and depths and most often appear randomly distributed. Aluminum and stainless steels in chloride environments are especially susceptible to pitting.

Pitting begins when surface defects, foreign particles or other variations in the metal lead to fixation of anodic (corroded) and cathodic (protected) sites on the metal surface. Acidic metal chlorides, which form and accumulate in the pit as a result of anodes attracting chloride ions, accelerate the pitting process over time. The nature of pitting often makes it difficult to estimate the amount of damage.

Crevice Corrosion

Crevice corrosion is a specialized form of pitting that particularly attacks metals or alloys protected by oxide films or passive layers. It results from a relative lack of oxygen in a crevice, with the metal in the crevice becoming anodic to the metal outside. For the crevice to corrode, it must be large enough to admit the electrolyte, but small enough to suffer oxygen depletion.

Erosion Corrosion

While erosion is a purely mechanical process, erosion corrosion combines mechanical erosion with chemical or electrochemical reaction. The process is accelerated by the generally rapid flow of liquid or gas over an eroded metal surface, removing dissolved ions and solid particles. As a result, the metal surface develops grooves, gullies, waves, rounded holes and valleys.

Erosion corrosion can damage most metals, especially soft ones like aluminum that are susceptible to mechanical wear, and those that depend for protection on a passive surface film, which can be eroded. Resulting damage can also be enhanced by particles or gas bubbles in a suspended state.

Intergranular Corrosion

Intergranular corrosion occurs between the crystals (or grains) that formed when the metal solidified. The composition of the areas between the crystals differs from that of the crystals themselves, and these boundary areas can become subject to intergranular corrosion. Weld areas of austenitic stainless steels are often affected by this form of corrosion, and the heat-treatable aluminum alloys are also susceptible.