Different Types of Corrosion

- Recognition, Mechanisms & Prevention

Dealloying, Selective Leaching & Graphitic Corrosion

Recognition of Dealloying and Graphitic Corrosion

What is dealloying? Dealloying is the selective corrosion of one or more components of a solid solution alloy. It is also called parting, selective leaching or selective attack. Common dealloying examples are decarburization, decobaltification, denickelification, dezincification, and graphitic corrosion.

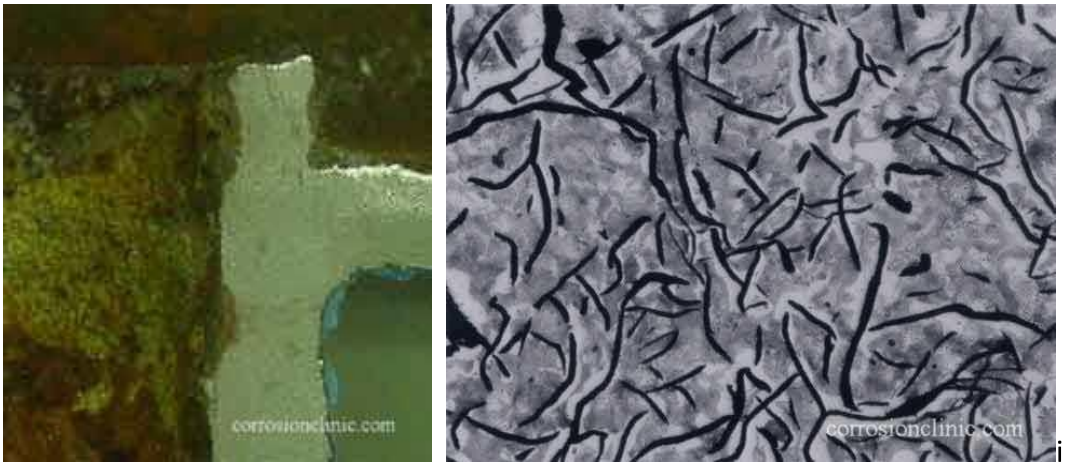
Decarburization is the selective loss of carbon from the surface layer of a carbon-containing alloy due to reaction with one or more chemical substances in a medium that contacts the surface.

Decobaltification is selective leaching of cobalt from cobalt-base alloys, such as Stellite, or from cemented carbides.

Denickelification is the selective leaching of nickel from nickel-containing alloys. Most commonly observed in copper-nickel alloys after extended service in fresh water.

Dezincification is the selective leaching of zinc from zinc-containing alloys. Most commonly found in copper-zinc alloys containing less than 85% copper after extended service in water containing dissolved oxygen.

Graphitic corrosion is the deterioration of gray cast iron in which the metallic constituents are selectively leached or converted to corrosion products leaving the graphite intact. Graphitic corrosion should not be confused with another term graphitization, which is used to describe the formation of graphite in iron or steel, usually from decomposition of iron carbide at elevated temperatures.



Graphitic corrosion of a gray cast iron valve

Mechanisms of Dealloying and Graphitic Corrosion

What causes dealloying? Different metals and alloys have different electrochemical potentials (or corrosion potentials) in the same electrolyte. Modern alloys contain a number of different alloying elements that exhibit different corrosion potentials. The potential difference between the alloying elements is the driving force for the preferential attack on the more "active" element in the alloy.

In the case of dezincification of brass, zinc is preferentially leached out of the copper-zinc alloy, leaving behind a copper-rich surface layer that is porous and brittle.

Prevention of Dealloying and Graphitic Corrosion

How to prevent dealloying? Dealloying, selective leaching and graphitic corrosion can be prevented through the following methods:

- Select metals/alloys that are more resistant to dealloying. For example, inhibited brass is more resistant to dezincification than alpha brass, ductile iron is more resistant to graphitic corrosion than gray cast iron.
- Control the environment to minimize the selective leaching
- Use sacrificial anode cathodic protection or impressed current cathodic protection

For more details on Dealloying and Graphitic Corrosion

Where can I learn more about dealloying and graphitic corrosion? More details on dealloying, selective leaching and graphitic corrosion are included in the following corrosion short courses which you can take as in-house training courses, course-on-demand, online courses or distance learning courses:

Corrosion and Its Prevention (5-day module)
Corrosion, Metallurgy, Failure Analysis and Prevention (5 days)
Marine Corrosion, Causes and Prevention (2 days)
Materials Selection and Corrosion (5 days)

If you require corrosion expert witness or corrosion consulting service on dealloying and graphitic corrosion, our NACE certified Corrosion Specialist is able to help. Contact us for a quote.