

Different Types of Corrosion

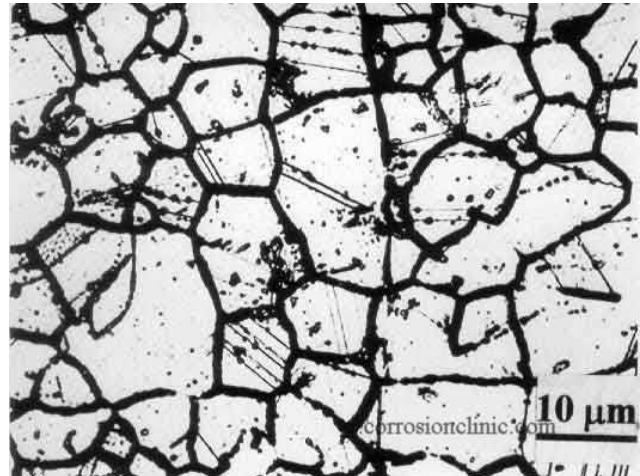
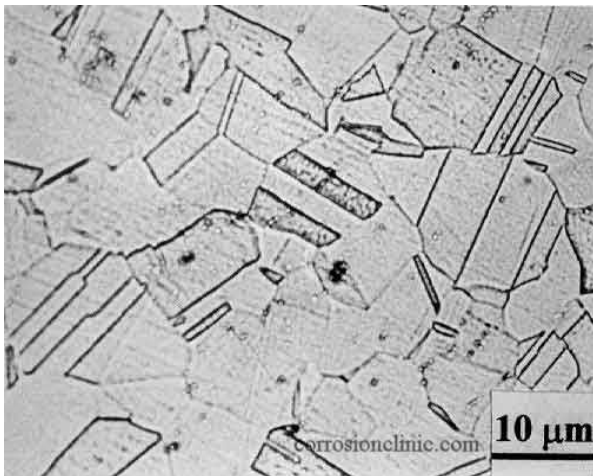
- Recognition, Mechanisms & Prevention

Intergranular Corrosion (Cracking)

Recognition

What is intergranular corrosion? Intergranular corrosion is sometimes also called "*intercrystalline corrosion*" or "*interdendritic corrosion*". In the presence of tensile stress, cracking may occur along grain boundaries and this type of corrosion is frequently called "*intergranular stress corrosion cracking (IGSCC)*" or simply "*intergranular corrosion cracking*".

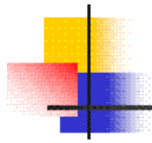
"Intergranular" or "intercrystalline" means between grains or crystals. As the name suggests, this is a form of corrosive attack that progresses preferentially along interdendritic paths (the grain boundaries). Positive identification of this type of corrosion usually requires microstructure examination under a microscopy although sometimes it is visually recognizable as in the case of weld decay.



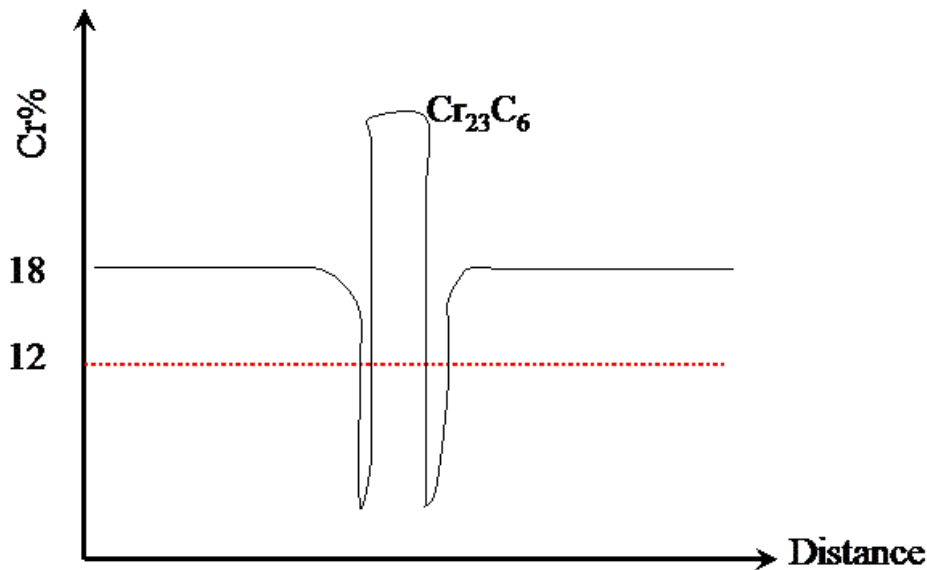
The photos above show the microstructure of a type 304 stainless steel. The figure on the left is the normalized microstructure and the one on the right is the "sensitized" structure and is susceptible to intergranular corrosion or intergranular stress corrosion cracking.

Mechanisms

What causes intergranular corrosion? This type of attack results from local differences in composition, such as coring commonly encountered in alloy castings. Grain boundary precipitation, notably chromium carbides in stainless steels, is a well recognized and accepted mechanism of intergranular corrosion. The precipitation of chromium carbides consumed the alloying element - chromium from a narrow band along the grain boundary and this makes the zone anodic to the unaffected grains. The chromium depleted zone becomes the preferential path for corrosion attack or crack propagation if under tensile stress.



Chromium Profile Across Grain



Intermetallics segregation at grain boundaries in aluminum alloys also causes intergranular corrosion but with a different name - "exfoliation".

Prevention

How to prevent intergranular corrosion? Intergranular corrosion can be prevented through:

- Use low carbon (e.g. 304L, 316L) grade of stainless steels
- Use stabilized grades alloyed with titanium (for example type 321) or niobium (for example type 347). Titanium and niobium are strong carbide-formers. They react with the carbon to form the corresponding carbides thereby preventing chromium depletion.
- Use post-weld heat treatment.

For more details

More details on intergranular corrosion are included in the following corrosion courses which you can take as in-house training courses, online courses or distance learning courses:

[Corrosion and Its Prevention \(5-day module\)](#)

[Corrosion and Its Prevention \(2-day module\)](#)

[Corrosion, Metallurgy, Failure Analysis and Prevention \(3 days\)](#)

[Marine Corrosion, Causes and Prevention \(2 days\)](#)

[Materials Selection and Corrosion \(2 days\)](#)

[Stainless Steels and Alloys: Why They Resist Corrosion and How They Fail \(2 days\)](#)