



What forms of corrosion can occur in stainless steels?

The most common forms of corrosion in stainless steel are :

A. Pitting corrosion

The passive layer on stainless steel can be attacked by certain chemical species. The chloride ion Cl^- is the most common of these and is found in everyday materials such as salt and bleach. Pitting corrosion is avoided by making sure that stainless steel does not come into prolonged contact with harmful chemicals or by choosing a grade of steel which is more resistant to attack. The pitting corrosion resistance can be assessed using the Pitting Resistance Equivalent Number calculated from the alloy content.

B. Crevice corrosion

Stainless steel requires a supply of oxygen to make sure that the passive layer can form on the surface. In very tight crevices, it is not always possible for the oxygen to gain access to the stainless steel surface thereby causing it to be vulnerable to attack. Crevice corrosion is avoided by sealing crevices with a flexible sealant or by using a more corrosion resistant grade.

C. General corrosion

Normally, stainless steel does not corrode uniformly as do ordinary carbon and alloy steels. However, with some chemicals, notably acids, the passive layer may be attacked uniformly depending on concentration and temperature and the metal loss is distributed over the entire surface of the steel. Hydrochloric acid and sulfuric acid at some concentrations are particularly aggressive towards stainless steel.

D. Stress corrosion cracking (SCC)

This is a relatively rare form of corrosion which requires a very specific combination of tensile stress, temperature and corrosive species, often the chloride ion, for it to occur. Typical applications where SCC can occur are hot water tanks and swimming pools. Another form known as sulphide stress corrosion cracking (SSCC) is associated with hydrogen sulphide in oil and gas exploration and production.

E. Inter granular corrosion

This is now quite a rare form of corrosion. If the Carbon level in the steel is too high, Chromium can combine with Carbon to form Chromium Carbide. This occurs at temperatures between about 450-850 deg C. This process is also called sensitization and typically occurs during welding. The Chromium available to form the passive layer is effectively reduced and corrosion can occur. It is avoided by choosing a low carbon grade the so-called 'L' grades or by using a steel with Titanium or Niobium which preferentially combines with Carbon.

F. Galvanic corrosion

If two dissimilar metals are in contact with each other and with an electrolyte e.g. water or other solution, it is possible for a galvanic cell to be set up. This is rather like a battery and can accelerate corrosion of the less 'noble' metal. It can be avoided by separating the metals with a non-metallic insulator.

