Rust & rust-like marks

Stainless steel is not corrosion-proof

In metallurgy, **stainless steel**, also known as **inox steel** or **inox**, is defined as a steel alloy with a minimum of 11% chromium content by mass. Stainless steel does not stain, corrode, or rust as easily as ordinary steel. It is thus not completely stain–, corrode-, or rust-proof, it is just much more resistant than carbon steel. It is also called **corrosion-resistant steel** or **CRES** when the alloy type and grade are not detailed. There are different grades and surface finishes of stainless steel to suit the environment to which the material will be subjected in its lifetime. Stainless steel differs from carbon steel by the amount of chromium present. Carbon steel rusts when exposed to air and moisture. This iron oxide film (the rust) is active and accelerates corrosion by forming more iron oxide. **Stainless steels have sufficient amounts of chromium present so that a passive film of chromium oxide forms which prevents further surface corrosion and blocks corrosion from spreading into the metal's internal structure**.

AISI 304 corrosion resistance

Excellent in a wide range of atmospheric environments and many corrosive media. Subject to pitting and crevice corrosion in warm chloride environments, and to stress corrosion cracking above about 60°C. Considered resistant to potable water with up to about 200mg/L chlorides at ambient temperatures, reducing to about 150mg/L at 60°C.

AISI 304 heat resistance

Good oxidation resistance in intermittent service to 870°C and in continuous service to 925°C. Continuous use of 304 in the 425-860°C range is not recommended if subsequent aqueous corrosion resistance is important.

Rust or rust-like marks

It is occasionally observed in sinks that have just been installed that marks looking like rust appear inside the bowl or even on the drainer. There are several reason that can cause this result and most of them are consistent with the fact that the sink has just been installed.

1. Dirt or metal particles in the water

It is very often the case that a new sink is installed where also the piping is new. Metal particles and dirt that have remained in the piping fall on the sink when it is first used. If the sink is not properly cleaned they can remain there and stain the sink. In most cases these stains can easily be cleaned afterwards by applying chalk on the stains and gently brushing it with a cotton cloth dipped in distilled water.

2. Chemicals used in cleaning the sink

Only products suitable for domestic sinks should be used. E.g. products high in chlorine if left in the sink can cause corrosion. In some cases construction crews may use industrial cleaning products after completing a kitchen and fail to completely rinse the sink afterwards.

3. Metal drilling or cutting around the sink

One of the most common causes for rust in new sinks is the use of cutting and drilling tools on the sink or around it. If the sink is not properly covered during such activities and not properly cleaned afterwards, there is a high possibility of corrosion. Hot metal particles fall on the sink during cutting or drilling metal (which is very common in new houses) and burn the sink or cause rust by staining there for long periods. This rust is in fact rust that has been absorbed by the external particles and does not come from the stainless steel.

4. Rusted nails, tools left on the sink

Rusted nails, screws, metal pieces or tools that are left on a sink for several days can cause the stainless steel to rust. Proper care should be taken especially during the construction of the house that such items are not left on sinks.

5. Air salinity

In areas with high salt content in the air, especially in ships, the chlorides from the salt will attack and destroy the passive film of the chromium more quickly than it can be repaired. In such cases the normal 304 stainless steel can rust, and other materials should be used instead (e.g. UNS S31254 gives high resistance to sea water attack due to high levels of Chromium and Molybdenum).

6. Fire

A small fire inside or under the sink can cause corrosion and rust marks.

Pitting Corrosion

Pitting corrosion, or pitting, is a form of extremely localized corrosion that leads to the creation of small holes in the metal. The driving power for pitting corrosion is the lack of oxygen around a small area.

Alloys most susceptible to pitting corrosion are usually the ones where corrosion resistance is caused by a passivation layer: stainless steels, nickel alloys, aluminum alloys. Metals that are susceptible to uniform corrosion in turn do not tend to suffer from pitting. **Thus, a regular carbon steel will corrode uniformly in sea water, while stainless steel will pit.** Addition of about 2% of molybdenum increases pitting resistance of stainless steels.

For a defect-free material, pitting corrosion is caused by the environment that may contain aggressive chemical species such as chloride (e.g. In sea water). Sufficient aeration (supply of oxygen to the reaction site) may enhance the formation of oxide at the pitting site and thus repassivate or heal the damaged passive film. An existing pit can also be repassivated if the material contains sufficient amount of alloying elements such as Cr, Mo, Ti, W, N, etc.