

May 2021



The NanoPrep solution to under film corrosion.

While industrial primers represent a critical foundation for paints and coatings in harsh environments, they have historically been unable to effectively deal with the eventual formation and recurrence of rust, mostly expressed as under film corrosion.

Traditional primers only cover the steel and adhere to it mechanically. This is the reason for the very onerous requirements for surface cleanliness and a “profile” that increases the surface area in contact with the primer. This increased surface, which the blasting operation produces, must be coated withing a very short time as the blasting operation makes the steel surface very reactive, causing faster oxidation. So called “rust converters” only encapsulate rust, without having a chemical reaction with it to truly convert it to a protective layer. When the paint/primer is scratched, chipped, or breached and moisture and oxygen migrate under the film, it allows the corrosion to spread, without a means to stop the spread of corrosion.

Another serious issue that is the cause of under film corrosion is the presence of chlorides on the surface of the steel. Conventional primers are so sensitive to chlorides, that the cleanliness requirements of the surface preparation are almost impossible to keep in a marine environment. There are two main mechanisms that cause residual soluble salts on a steel surface to accelerate corrosion:

1. When some trapped moisture reacts with the salt, it creates electrolytes on the surface and underneath the coating. This process speeds up crevice pitting and general corrosion. Crevice pitting can cause mechanical failure, not just coating failure.
2. Residual surface salts cause osmotic blistering, which occurs when moisture diffuses through the coating film via osmosis and dissolves the water-soluble salts. The entrapped salts are hygroscopic, which means that they draw moisture from the surrounding area and from the air. The reaction with the salt creates concentrated pressure under the film, which eventually exceeds the adhesion strength of the coating and breaks through the surface, exposing the metal underneath. This causes accelerated corrosion in the exposed area, that penetrates underneath the coating and causes failure.

The bottom line is that practically all other primers are alkaline chemically and they do not react to passivate the salts. This means that any residual salts left on the surface, will eventually cause the coating to fail. This is the reason for the strict specifications regarding chlorides, by coating suppliers. In practical terms, it is almost impossible to completely eliminate salts on the surface in a Marine environment, or in an industrial environment. Even with the best blasting (which makes steel very reactive), if the coating is not applied within a very short time after blasting, you will have chlorides and beginning of flash rust.



How is NanoPrep different?

Preventing under film corrosion due to mechanical damage: NanoPrep is based on phosphoric acid. The acid reacts with the steel and or rust, to create a meaningful layer of iron phosphate. The Iron phosphate, being an impermeable material, protects the steel where it is present, from any reaction with oxygen. When the coating is mechanically damaged to expose the bare steel, the bare spot will rust, but the rust will be contained to the damaged spot while the iron phosphate around the damage will prevent any further oxidation. Applying a coat of NanoPrep to the damaged area, restores the Iron phosphate protection to that area and prevents any further corrosion.

Preventing any under film corrosion due to presence of chlorides: NanoPrep is **ACIDIC**. The phosphoric acid in NanoPrep reacts with the alkaline salts and passivates them. This means that the salts become a non-reactive, neutral, part of the coating. The iron phosphate layer that NanoPrep creates on the surface of the steel is impermeable and does not allow moisture, or most other chemicals for that matter, to penetrate to the substrate. Even when the coating is damaged, the presence of iron phosphate, all around the damaged area, prevents corrosion from spreading. The iron phosphate and the remainder of the NanoPrep layer, have a “diffusion zone” where the acrylic polymer matrix of NanoPrep and the iron phosphate are mixed, so we have an integrated coating that is chemically bonded to the substrate, providing excellent adhesion and corrosion protection. The neutralization of the chlorides and the layer of iron phosphate, that is bonded to the substrate, also eliminate any chance of under film corrosion (UFC).