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Prevent Red Rust By Controlling Process Solution

Red rust is a product of iron and oxygen combining in a hydrated form to create corrosion on metal. It is a major concern in metal finishing operations, such as painting and plating.

Some Causes

Flash rust can occur during the processing of metal items, or it can develop over a period of months or years. The corrosion that is feared by metal finishers is the flash rust that can occur during preparation of the product. Flash rust occurs when the balance of the reaction mechanism is disrupted by an excess of dissolved ferric iron. It is usually found as the ratio of ferrous iron to ferric iron decreases in the phosphating solution. The fundamental chemistry of the phosphating process puts ferrous iron in the solution, which reacts with the phosphate ions. This occurs rapidly because of the high concentration of insoluble phosphate ions and salts that make up the majority of the conversion coating. Some of the ferrous iron reacts with the accelerators in the solution to form the ferric iron in the coating, and provides an oxidizing effect at the same time. A portion of the salting action falls out of the solution and forms a sludge in the tank. Unless the solution is controlled with the pH, concentration, temperature, balance of accelerator, and minimum soils, the bath will become contaminated.

Contaminated Solution

When a bath becomes contaminated, it can create deposits on the surface of parts that show up as corrosion—or flash rust—as the parts come out of the drying section, or even between process stages.

Phosphoric acid is normally added to a bath to adjust the pH. That will lower the pH to the desired value, but it does not replenish other components or ingredients. As a result, the solution gives a falsely higher reading. Because the titration is simply a neutralization of the phosphoric acid in the bath, the test cannot distinguish between the addition of iron phosphate concentration and the phosphoric acid. Even though an analysis many indicate that the bath is in good working order, the phosphate conversion mechanism is no longer operating as formulated.

When only phosphoric acid is added, the other essential components, such as accelerators, buffering agents, wetting agents, and surfactants are missing or depleted. The bath begins to perform in a sluggish manner, depositing more phosphate with more free ferrous iron, causing flash rusting. The excess amount of iron deposited can cause flash rust during the rinsing or drying stages, and interferes with the performance of the coating. As the balance begins to fall, there can be another condition that can be seen as the surface begins to turn to a golden iridescence, with flashes of the blue-gray conversion. The color may give the appearance of a good job, but the golden, purple and red colors are just rust in a protected condition.

Work with Suppliers

Working with a chemical supplier and steel supplier can help avoid flash rusting. It can help prevent the loss of corrosion protection on painted parts that are marred or scratched during use.

Steel that has not been properly stored or handled can begin to develop corrosion. Attempting to remove the corrosion by lowering the bath's pH to provide more etching, however, can add more iron oxides to the solution. This creates the conversion that forms more iron and less phosphate complex.

Keep Standards High

Baths should be tested by the usual methods of titration and kept within established ranges. Test panels should be processed often, and inspected before and after painting to determine that the proper phosphate conversion has been deposited and good corrosion protection provided. Never become complacent, even when several months of testing show good results. Keep quality control standards high for managing the solution and testing finished parts. It can keep you from ending up with a red face. o

SUR/FIN® Sessions

Powder Coating
Wednesday, June 12,
1–5 p.m.

Corrosion Prevention & Inhibition
Thursday, June 13, 8–11 a.m.

This issue contains abstracts of papers in these sessions.