

Question of the Month

Q: Why does my galvanized coating look like it developed a bad case of acne in the zinc bath?

A: Rough galvanized coatings can be caused by steel chemistry, dross inclusions and a few other factors.

Steel Chemistry

Silicon and phosphorus in steel act as catalysts during the galvanizing reaction. Steel with silicon and/or phosphorus levels outside the recommendations in ASTM A 385 is considered reactive steel and can create galvanized coatings with thicker and rougher looking coatings, as seen in *Picture 1*.

Steel heat chemistries are helpful for determining element levels in steel; however, they are samples of the total heat of steel and sometimes are not completely representative of the steel since individual pieces of steel can have levels higher or lower than the sample. In addition, silicon and phosphorus are not always distributed evenly throughout the steel. Some areas of the steel can have higher silicon or phosphorus levels and thus create coatings that grow differently than the surrounding areas.

The galvanized coating on reactive steel can have ridges or striations, as seen in *Picture 2*, and at other times be rough over the entire surface. Rough galvanized coatings do not affect the corrosion resistance of the steel and sometimes can increase the service life of the product because reactive steel has thicker coatings than non-reactive steel. On applications where the steel will be handled frequently, such as on handrails, the coating must be smooth for its intended use and will be rejected if the galvanized coating is rough.

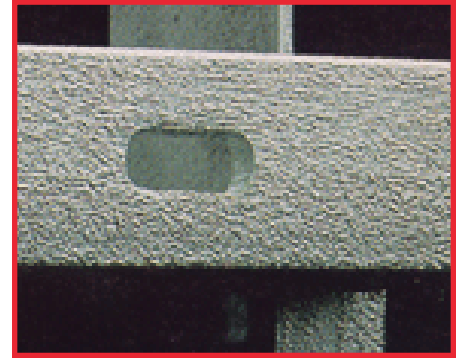
Steel with phosphorus levels over 0.04% produce dull coating areas and ridges of thicker coating where there is increased intermetallic growth. The end result is a rough surface with a ridged appearance, as seen in *Picture 3*.

Dross Inclusions

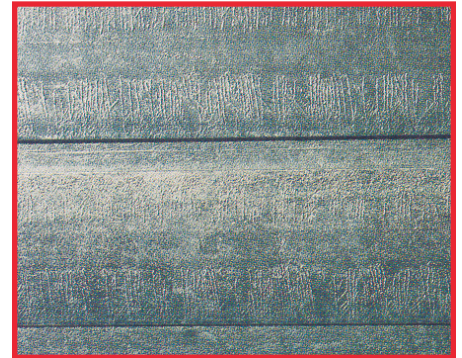
Another source of rough of galvanized coatings is dross inclusions. Dross is created when free iron particles in the galvanizing kettle react with the molten zinc. The dross particles can then adhere to the galvanized coating as the steel is lowered or raised from the kettle and appear as pimples on the coating, as seen in *Picture 4*. Dross inclusions do not affect the corrosion resistance of the coating; however, if the dross inclusions are large and can be knocked off the galvanized coating and create a bare spot, then that situation is rejectable if those areas cannot be repaired in accordance with ASTM A 780. Galvanized steel can also be rejected when dross inclusions affect the intended use of the product, such as on hand rail or steel to be painted after galvanizing, as mentioned previously.

There are several ways to reduce production of dross in the kettle and therefore minimize dross inclusions. Iron particles in the kettle can be reduced by fully rinsing the steel after cleaning in the pickling tank, and limiting the iron content in the preflux.

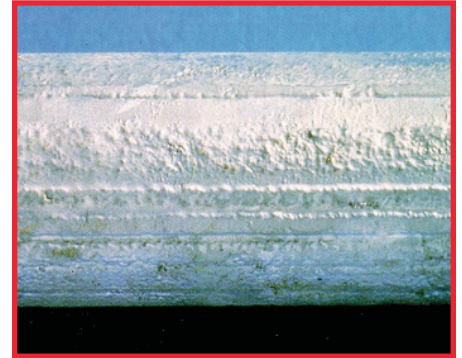
Picture 1



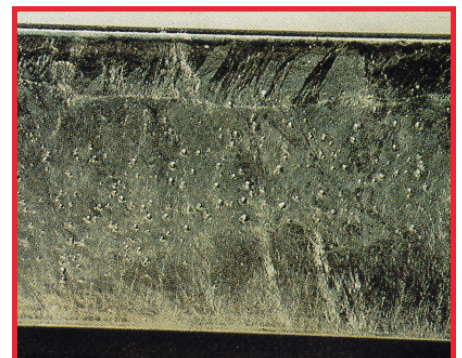
Picture 2



Picture 3



Picture 4



Regulating element additions, such as nickel and aluminum weekly helps to limit iron precipitation in the molten zinc because these elements can decrease iron solubility in the zinc. Maintaining zinc kettle temperatures, especially near the top of the kettle along the walls, greatly reduces floating dross. Lastly, frequently drossing the kettle will help to remove dross.

Other Factors

Rough galvanized coatings can also be caused by conditions other than steel chemistry or dross inclusions. If a steel surface is very rough prior to galvanizing due to mechanical cleaning such as blasting the possibility for that steel to have a rough galvanized coating is much higher than steel with a smooth finish. Excessive blasting or excessive pickling can also create rough galvanized coatings because they create surface roughness in the steel before it enters the galvanizing process.

Summary

Rough galvanized coatings can be caused by several factors, including steel chemistry, dross inclusions, rough steel surfaces prior to galvanizing, excessive blasting or excessive pickling. Rough galvanized coatings can only be rejected when the roughness of the coating affects the intended use of the product, such as on handrail or parts to be painted after galvanizing.