

News

Preventing Plate-Out in Electroless Nickel Solutions

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Q: We run a low-phosphorous electroless nickel plating solution and recently pulled quite a few pounds of nickel pellets from our tank after draining. How do we prevent this kind of plate-out?

A: It is important to take steps to prevent plate-out in electroless nickel plating solutions. The occurrence of plate-out will cause defects and impact the quality of the deposit. It can also lead to increased costs due to wasted nickel and necessitate chemical stripping, resulting in increased labor and downtime.

There are multiple contributors to plate-out worth examining. The following are areas of concern.

Insufficient passivation/stripping of the tank and plating equipment.

Proper passivation/stripping is essential for the plating solution to remain stable. Passivation is performed using 30 to 50 percent by volume dilution of conc. nitric acid, or a mixture of sulfuric acid and hydrogen peroxide (formulas available upon request) if nitrate contamination is a concern. The latter is less effective and must be used at elevated temperatures and increased times. The minimum exposure to nitric acid is typically 3 to 8 hours. This allows time to strip nickel plate-out and produce passive oxide films. Nickel content in either a passivating or stripping solution must be below 2 oz/gal (15 g/L) and the stripping solution should be replaced when nickel concentration is too high or the stripping rate is greatly reduced. Adjustment of these parameters may be required if plate-out is particularly significant.

Poor EN solution control

Maintaining a low concentration of the EN solution activity (i.e. Ni metal and Hypophosphite conc.)

- If the solution chemistry is maintained below 80% or greater activity, instability of the solution can occur. The stabilizer concentrations will be below their optimum concentrations at the lower activity, which will negatively impact the solution stability.
- The same can occur with high loading and inadequate replenishments. To maintain activity above 80%, it is better to make frequent small additions of the replenishment components.

Excessively high solution temperature or solution pH

Temperature and pH are critical for driving EN deposition reactions. Solutions can become overactive and unstable when temperature and/or pH are increased beyond their acceptable ranges, per supplier TDS, leading to plate-out.

Aged or inadequate equipment

Etched/rough tanks lead to plate-out. It is advisable to ensure that the tank surface condition is relatively smooth and free of pits.

- Inadequate anodic protection

Anodic protection is the application of a controlled DC voltage to stainless steel. All connected stainless steel equipment (heaters, pumps, etc.) must be connected.

Properly maintained anodic protection will reduce plate-out and nitric acid waste.

Poor or low solution agitation

Agitation is important to provide parts with fresh solution and move contaminants/particulates to the filtration units. Too much agitation can increase the activity of the stabilizers, leading to potentially reduced plating speed. However, some degree of agitation is necessary to ensure proper mixing of the solution to avoid "hot spots" and thus potential decomposition.

Poor filtration

Electroless nickel solution requires constant filtration. One (1.0) micron filters are recommended at a minimum solution turnover of 10/hr. Filters are designed to catch any foreign particulate that may cause plate-out.

Improper heating devices

Poorly agitated solutions often cause localized overheating. To prevent overheating, it is recommended that the agitation surrounding any device emitting heat have adequate velocity.

Contamination/introduction of particulates from equipment or substrates

Metallic flakes or fines often enter the solution via corroding metallic features of the

plating line and equipment or substrates, such as castings. The particles are only sometimes immediately filtered out, often leading to plate-out/solution decomposition.

Ensuring your electroless nickel solution operates consistently is critical to providing a deposit of the desired quality. For this to occur, all the above-mentioned factors must be monitored and maintained.

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