Troubleshooting EN Plating Solutions

By Michael Aleksinas

Troubleshooting Categories

The chemical reduction potential of the electroless nickel (EN) plating reaction can be affected by many factors. A working knowledge of the chemistry of the techniques is necessary to ensure reliable, consistent results. There are four basic categories of potential problems outlined here. By taking a logical approach to these areas, troubleshooting can be accomplished effectively and efficiently.

Bath Chemistry Imbalance

Components of the EN bath include an aqueous solution of nickel ions, reducing agent(s), complexing agent(s), buffer(s) and stabilizer(s). These work in combination with each other and operate in specific concentration, temperature and pH ranges. Optimizing these parameters can be different from solution to solution. Maintaining the optimum metal content, reducer concentration, pH and temperature of the solution can minimize many of the technical problems that can arise. Analytical techniques to determine these parameters can be obtained from textbooks or from suppliers.

SHOP TALK TIP

Troubleshooting Guide: Poor Adhesion and/or Blistering

Probable Cause	Suggested Remedies
Improper surface conditioning	Improve cleaning & pickling cycle
Poor rinsing	Improve rinse & transfer time
Poor zincating (on aluminum)	Analyze/correct zincating solution
Metallic contamination	Dilute or dummy plate solution
Organic contamination	Carbon treat solution
Surface passivation	Reduce transfer times
Improper heat treatment	Correct time/temperature of heat treatment

Pretreatment of Substrate

Quality results require proper preparation of the substrate to be plated. Poor surface preparation can cause lack of adhesion, deposit porosity, roughness, non-uniform coatings and/or dark deposits. A properly prepared sub-

strate with surface contamination removed should leave a clean, nominally oxide-free surface.

Pretreatment processes depend on the type of soils present. Pretreatment choice should be the best available for the specific substrate and should be closely monitored. Cleaners and pickling solutions should be changed at regular intervals to eliminate the possibility of ineffective cleaners and descalers, which can cause poor adhesion, streaky deposits or blistering.

The quality of the substrate must also be checked carefully as a potential problem source. Plating problems resulting from inferior substrates often are misdiagnosed as pretreatment or chemistry problems.

Improper temperature control when casting aluminum or zinc die-cast parts can cause lamination of the substrate, leading to uneven appearance in the end-plate.

Equipment/Mechanical Needs

EN solutions should have constant filtration to eliminate any particulate bath impurities, such as dust, sand or loose maskant material. With proper filtration, roughness of the final deposit can be greatly reduced or eliminated. Filters should be replaced on a regular basis.

EN plating tanks can be heated internally or externally. Excessive localized overheating can cause plate-out, roughness or bath decomposition.

Adequate agitation of the solution is necessary to provide a fresh supply of solution to the parts, as well as to enhance the removal of hydrogen gas produced during deposition.

In most cases, high-temperature, stress-relieved polypropylene is the material for tank construction. Etched tanks can become more active toward electroless processes and should be replaced to minimize plate-out.

Contamination of the Solution

The EN plating reaction is affected by many impurities. Trace impurities can be organic (oils or solvents, which can cause cloudy, streaked deposits and poor adhesion), or inorganic (silicates or nitrates, which can form gelatinous films on parts, causing cloudy deposition or pitting). Improved rinsing can help prevent these problems.

Metallic impurities can be introduced into the bath by drag-in from previous tanks, dissolution of base metal of the substrate, poorly cleaned or exposed plating racks, or the water itself. (if using tap water, change to deionized water.) If metallic contaminants are in excessive quantities, severe problems can arise. P&SF

About the Author

Michael J. Aleksinas is the chief executive officer of Metal Chem Inc., Greenville, SC. He contributed a chapter on troubleshooting electroless nickel plating solutions to the book, Electroless Plating: Fundamentals & Applications, edited by Glenn O. Mallory and Dr. Juan Haydu, and published by AESF in 1990. His chapter was the basis for the "Troubleshooting" section in AESF's Illustrated Lecture series on electroless deposition.

Editor's note: *This information was excerpted from the "Troubleshooting Electroless Nickel Solutions" lecture in AESF's new Electroless Deposition of Metals course. The course will be given November 8-9 in Los Angeles, CA.*