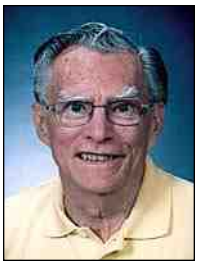

Do's & Don'ts

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Getting the Most from Your Electroless Nickel: *Lowest Cost and Best Performance*

In the August 2007 issue of *P&SF*, I wrote about the "Do's & Don'ts" of electroless nickel-phosphorus plating solutions. In that issue, there were a few suggestions for extending the useful life of the EN plating solution. Since then, in view of global competition, and rising and fluctuating nickel and chemical costs, it has become extremely important to get the most out of the process of electroless nickel plating. So, to begin, I would like to emphasize those items and add a few additional ones. Here are the Do's and Don'ts from that earlier column:

Do's

- Use high bath loading to improve efficiency and save costs.
- Use nickel acetate or nickel hypophosphite for part or all nickel replenishments of the nickel component. These are slightly more expensive, but they may extend the life of the bath.
- Use the bath and shut it down as soon as possible after the work is complete.
- Accumulate items to be plated so the actual plating time is short.
- Add maintenance materials continuously or make frequent additions.
- Remove anything that falls into the tank as soon as possible.
- Pump the plating bath through a suitable filter into a storage tank soon after use.
- Use a covered tank for plating and for storage.
- Strip the nickel from the walls and bottom of the plating tank frequently. I prefer sulfuric acid and hydrogen peroxide instead of nitric acid. Any nitric acid left after rinsing is harmful to the plating bath.
- Use high density polypropylene tanks or equivalent.
- Filter the plating solution continuously using a filter and filter media recommended for EN baths.
- Follow the instructions of the chemical suppliers.
- Use mild agitation for most formulas. High agitation can cause streaks, step plating or no plating at all (There are a few baths that depend on mild air agitation for help in stabilizing the bath.). Most recommend staying away from air as the source of agitation.

Don'ts

- Let particles of any kind get into the plating bath.
- Let nickel plated onto the insides or bottom of the plating or storage tank accumulate.
- Underload or overload the bath (ft^2/gal).
- Let nitric acid stay in the tank or filter system or storage tank.
- Use flexible tank liners. They contain waxes, oils and sometimes cadmium and most use thallates. All of these are bad for the plating bath. They cause pitting, over-stabilization, dark streaks, etc.
- Let the EN bath stand idle for long periods of time. Hypophosphite will be consumed and reduced, thus shortening the bath life (fewer turnovers).

At a recent EN Conference that I attended, one whole session was devoted to extending the useful life of EN solutions and to the over-all conservation of materials and energy. We must use the best technology available to conserve and be competitive in the world market and in our own local market.

Kurt Weamer reminded us to keep a clean work area, change filters often, keep chemical inventory form aging by using FIFO inventory system. Don't leave containers open. Be accurate with chemical analysis. Make sure all standard solutions are correct and not aged. Follow the procedures carefully. An example from my own experience: The analytical procedure commonly used to determine sodium hypophosphite requires 30 minutes in a dark area after adding the reactants. I have observed other chemists often opening the cupboard that contained the flask to be kept dark. This results in an incorrect answer. Additions or no additions would then be made incorrectly. All instruments should be calibrated often against known standards.

Rutao Liu, *et al.*, in the *Journal of Applied Surface Finishing*, July-September 2007 issue, describe a cyclic voltammetry method to determine sodium hypophosphite in EN solutions that appears to be more accurate than the present titration method.

Grant Keers and Graham Orgill suggest "Steady State" EN. Using a system that includes electrodialysis combined with nickel recovery, automatic pH control, and automatic water dosing to keep the concentration of sodium sulfate and orthophosphite in the optimum with a bleed stream of 10 to 20 L/hr. Automatic feed chemical controllers for nickel content and pH and fully automated additions of replenishing chemicals are described. The economics of using the automatic operating "Endless Life" and steady state systems provide significant cost savings and good quality repeatable results.

Helmut Horsthemke and Stanley Zabrocky suggest that "Endless Life" may be possible, using a sulfate-free nickel source combined with "bleed and feed held at ten metal "turnovers." Automatic chemical feed would lower costs substantially over the "dump and replace after six to ten metal turnovers.

So, adding to my "Do's and Don'ts" list from August 2007:

Do's

- Use clean DI water in the pre-rinse and for the EN plating solution make up. The DI water system should have a carbon filter before the resin beds and the system should be sterilized periodically to prevent algae, molds and bacteria from contaminating plating solutions and rinses. These growing things can cause high stabilizer consumption, rough deposits and/or nodules and poor adhesion.
- Be precise with thickness measurements. Additional deposit thicknesses are costly.
- Be sure the thickness specification is adequate for the application.
- Keep racks stripped, clean and free from cracks in the rack coating that can entrap preparation solutions.
- Plan production to run all the items continuously then cool the tank soon after the last load.
- Filter the solution back into the plating tank when ready for production.
- Refer to the 2007 EN Conference papers.

Don'ts

- Keep the solution hot when not in use. There are heat exchangers that can heat the EN solution quickly and cool rapidly. Big savings in sodium hypophosphite consumption will result.
- Don't use city water or well water for make up or additions to the EN plating solution.
- Don't overheat the plating solution. Check and calibrate temperature controls. *P&SF*

Advice & Counsel

Continued from page 21.

Following graduation, he worked his way through the University of Kansas Graduate School as lecture assistant and assistant instructor in chemistry. He received his M.A. in 1930 and his Ph.D. in chemistry in 1934.

While working on the thesis for his doctorate, Dr. Stareck discovered the method of color plating, later to become known as Electrocolor. In 1933, he was awarded the Roy Cross Research Fellowship to further his studies of color plating. The following year, he became affiliated with the Kansas City Testing Laboratories and the Bar Rusto Plating Corporation in Kansas City, Missouri, where he undertook commercial development of the color-plating process.

In 1935, he joined the research staff of United Chromium, Incorporated. At its Waterbury, Connecticut laboratories, he continued his research activities on Electrocolor and shortly afterwards developed the related process of electrodepositing patterns, known as Patternplate. For these novel contributions in the field of coloring metals, the Franklin Institute awarded him the Edward Longstreth Medal in 1939.

In 1941, Dr. Stareck moved to the Detroit research laboratories of United Chromium as Director of Research. Some of the better known processes developed under his direction are Electrocolor, Patternplate, copper plating from pyrophosphate solutions, and high-speed chromium plating.

More next month. *P&SF*

Answers to I.Q. Quiz #453

1. Remove the bulk of the soil on the workpiece.
2. Remove surface oxides, microscopically etch the surface and leave the surface chemically active to assure an adherent plated deposit.
3. Dispersion, where dirt particles are broken up into smaller ones and dispersed by surfactants.
4. Fatty-acid containing oils (e.g., vegetable oils) found in lubricating operations are removed by converting them into soluble soaps.
5. Cavitation involves the formation and sudden collapse of tiny bubbles in the solution. The resulting force "chips away" at tenacious soils.

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