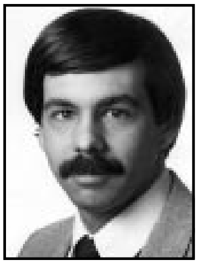

Finishers' Think Tank

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Have a problem on the finishing line? Please e-mail your question (aesf-journal@worldnet.att.net), use the postpaid form on our Readers' Service Card, or mail to "Finishers' Think Tank," 12644 Research Pkwy., Orlando, FL 32826-3298.

Storage of EN-processed Parts

Q. We process parts in electroless nickel. When handling and storing these parts after processing, they sometimes tend to darken and tarnish. Can this be prevented?

A. Although electroless nickel (EN) is a highly corrosion-resistant coating, it still has the propensity to tarnish if conditions warrant it. The main cause of tarnishing is the quality of the rinsewater, particularly the final rinse. If the final rinsewater has a concentration of nickel >25 ppm, or if the pH varies much from neutral, the plated parts will tarnish after plating.

In addition, parts placed in a corrosive environment—or one that has a high degree of sulfur—will also tarnish. When a shop is operating a direct-fired oven using natural gas, for example, the high temperature and high humidity will activate the mercaptan or sulfur-bearing materials in the gas, which will react with the nickel and cause tarnish. One method of providing a level of protection for the EN surface is to passivate it by immersing in ~0.25 oz/gal of chromic acid solution. Another way is to use a dilute solution of soap (such as Ivory Snow™ or other fatty acid soap), which will create a mild film on the surface that will act as a water-shedding agent.

As a last resort, there are proprietary anti-tarnish chromate processes available that will not only protect the surface but will also increase the anti-corrosion properties of the EN by passivating the surface to a high degree, including any pores or areas where base metal might be exposed. This technique is especially important when processing highly porous cast iron.

Copper Alloy Deposits

Q. How do we prevent stains and tarnish on copper alloy-plated parts?

A. Preventing tarnish on copper alloy-plated parts is a test of your aptitude as a plater, because no other system will require expertise in all of the following:

- Base metal quality
- Preparation cycle
- Solution quality
- Post-treatment quality

The above are listed as "quality" issues, because deficiencies in those areas can result in stains and tarnish (depending on how the cyanide interacts with the process), as well as spots in the final finish.

Base metal—If the base metal is porous, it will retain solutions, cyanides, acids, cleaners and other process chemistries in the surface during plating, resulting in a spot or point stain that develops sometime after the process. Thoroughly rinsing the process chemistry from the surface is vital.

Preparation cycle—If the part is either over- or under-prepared, it will generate porosity, leaving scale or oxidation on the surface that will cause process solutions to become entrapped on or in the surface, resulting in spots and stains.

Plating solution—The plating process may contain particulates, cyanide solutions will generate carbonates and other insolubles that become incorporated in the deposit, causing stains and tarnish.

Final rinses—Post-plating rinses will leave a concentration of chemicals on the surface that must be removed to avoid staining. The quality of the final rinses should be <100 ppm of dissolved solids, and should be kept at that level or below.

Although copper alloy deposits are subject to the same good plating practices as other coatings, the copper alloy surface is more sensitive to tarnish, stains and oxidation. The problems encountered with poor plating practices, therefore, are magnified.

Brass-flashing Over Nickel

Q. When brass-flashing over nickel, we are experiencing problems with color changes after coating and baking the water-reducible lacquers. The brass formulation is standard textbook, except that it has a nickel contamination of >500 ppm. How do we correct the problem?

A. Nickel in a cyanide solution can be a real problem. In brass, it will make color control difficult and will cause streaks and color changes upon standing—especially on high-temperature curing of the coating. Color difficulties tend to begin at ~100 ppm, so you are doing well to control the color of the deposit at such high contamination levels.

The conventional wisdom in this situation has always been to add complexing agents to "tie up" the nickel and prevent it from causing problems, but this is only effective if the post-treatment is mild (<150 °F).

Electrolysis of the plating solution at a high cathodic current density (40–60 amps/ft^2) has met with limited success in removing nickel from brass solutions. To get down to acceptable levels (<100 ppm), however, this treatment may be too time-consuming and ineffective.

Because there is an industry-wide effort to offer the marketplace more tarnish- and corrosion-resistant coatings, this problem has become more acute in recent years. Most advance coatings over brass are largely clear coatings that require curing temperatures of >300 °F, which seriously tests the integrity of the brass plating. Most contaminants, therefore, will cause problems. Brass solutions that are serving aggressively post-treated process systems will need to be treated with great care. Purification of the process systems is essential to operational reliability—filtration and maintenance must be professionally executed with chemical parameters strictly enforced.

Ion exchange or reverse osmosis can be used to purify the rinse tanks between the nickel and brass, keeping the nickel out of the plating process. Unfortunately, the process solution in your facility may be too far gone for purification. Your option is to send it out to an appropriate facility for treatment and disposal of the contaminated solution.

Alternatives to Cyanide

Q. We are a pollution prevention group working for a company that makes helically twisted copper wire. They are installing a new cyanide silver plating line for copper wire. Is there any process available that would be compatible with the cyanide process in terms of cost and process time?

A. Although cyanide is a dangerous substance, it is an asset in plating because it allows for operation in a wide current density range. It also allows for a pure deposit to be formed on the surface. When processing wire with silver (for its electrical properties), the silver deposited will be of known properties and should cause minimal operational problems. As processes are developed with cyanide replacements, they take the form of heavy organic complexing agents that tend to become incorporated in the deposits and change the electrical characteristics of the silver. This, then, is not an option if your operation is targeting the electrical properties of the silver.

There is an advantage in your case, however, because recovering solution from wire plating lines is easy and straightforward. The wire is handled in a continuous system and passes through guides that can be turned into "squeegees" to wring the cyanide from the surface. You should therefore focus on the recovery option rather than looking for questionable plating alternatives.

My company deals with large amounts of cyanide. You do not have to discharge cyanide, but if you do, it is a well-known science and destruction is complete. As noted earlier, cyanide replacements complex other metals, acting as scavengers for heavy metals in the wastewater and causing discharge problems that cannot be addressed by conventional means.

In designing an appropriate line for your customer, it is important to understand the characteristics of the deposit that are required for the job you have been asked to perform, and to remember that there is a lot of history with cyanide. It may not be replaceable.

Desmutting 380 Aluminum

Q. We are plating 380 aluminum wheels and are unable to use concentrated nitric acid in our precleaning process because of the fumes. The non-nitric materials used for desmut leave a smut on the surface that stays throughout the process. If we use an EN strike over the zincate, we don't see the smut. Do you have any suggestions?

A. One of the most difficult-to-plate alloys of aluminum is 380. With about nine percent silicon and 3.5 percent copper, it is used for strength and functionality, but the issue of properly desmutting the alloy must be addressed. Even if you think you are adequately preparing the parts, I suggest that they be severely tested (*e.g.*, grind saw testing on a regular basis) to assure necessary adhesion.

Non-nitric desmutters do not always work on all parts or all alloys of aluminum. If a smut is remaining on the surface, it has not been adequately prepared. A nitric is necessary to remove a smut in 380 alloy that is largely copper. Another aspect of the problem is that the 380 alloy is confirmed when produced by the manufacturer. In fact, there is migration in both the melt and the casting operation, so the surface of the parts you receive may not be the same analysis of the alloy that is cast. You must therefore address the surface to ensure that it is clean and smut-free in the preparation cycle before proceeding.

For proper preparation, use a minimal etch, such as 16 oz/gal ammonium bifluoride, at 110 °F. Using this acid etch instead of an alkaline etch will minimize the attack on the surface of the aluminum and reduce the level of smut. Next, the surface must be desmutted by using both nitric acid to remove the copper smut component and a fluoride adder to remove the silicon from the surface. In summary, parts that are produced with smut will fail, so bite the bullet and install the controls to handle the nitric acid fumes so you can be proud of the parts you are producing. ***P&SF***