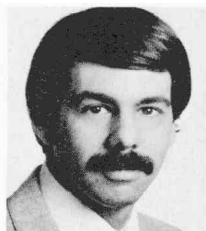


FINISHERS' THINK TANK

By Marty Borruso



Got a problem on the finishing line? To send in your question, use the handy postpaid form on our Readers' Service Card or send a letter to Finishers'

Think Tank, 12644 Research Pkwy., Orlando, FL 32826-3298.

Cu & Ni on Zn

Q. How can I successfully deposit copper and nickel on complex zinc die castings?

A. The sample connectors you sent along with your question present certain challenges to the electroplate. First, they have complex configurations and many 90° angles, which are difficult to cover in conventional systems. In addition, the parts exhibit poor surface quality. These surface imperfections will show through the deposit if the parts are handled in a conventional cleaning/activation cycle. The parts have also retained a large amount of residue from burnishing materials. This factor will add to problems on the finishing line.

I would offer the following recommendations:

1. Mill in a chemical polish to remove some or most of the surface imperfections and cleanly activate the surface so that it may accept the subsequent copper deposit evenly.

2. Barrel copper plate the parts in the following solution for at least 45 rein, or to a minimum 0.3 mils. Because of the sharp angles of the parts, you must keep the load sizes down and the barrel rotation as slow as possible.

Copper cyanide
6.0 oz/gal

Free sodium cyanide
1.0 to 1.5 oz/gal

Potassium hydroxide
<1.0 oz/gal

Temperature
135° F

The rotational speed of the barrels will be a factor in the success or failure of the deposit integrity. A high rotational speed will cause the copper at the edges of the parts to wear off as fast as it is deposited. Keep the efficiency of the copper solution as high as possible in order to deposit as much copper as possible in a short period of time. In doing so, you will avoid attacking the substrate. Try to keep the carbonate level below 8.0 oz/gal.

3. Barrel nickel plate the parts in as non-aggressive a nickel plating solution as possible. Remember, any area not completely covered by copper will be reattacked by the nickel solution. Use a high-pH nickel solution to obviate some of the problems you might incur as a result of a porous copper deposit. Keep the brightener level as low as possible to avoid increasing the stress that is inherent in a nickel bath employed over zinc substrates.

Salt Spray Resistance Of Cast Aluminum

Q. I am experiencing premature salt spray failure of parts (<15 hr) when processing cast aluminum. What can I do to increase the service life of my parts?

A. The major factor affecting the corrosion resistance of coatings applied to cast aluminum is surface preparation and porosity. Surface preparation of the parts will either minimize or exacerbate the porosity problems. Failure of the coatings to protect the surface is usually evidenced by a galvanic effect that tends to undermine the coating. Degeneration of the coating is rapid, and there is some associated lifting of the deposit as a result of the lateral corrosion underneath.

Porosity of cast aluminum parts is legendary and has been associated with processing problems for as long as the technology for plating on aluminum has existed. At this time, I'll address the preparation of A-356 alloy, which is probably the most common in use today. Improvements may be made

by refining the casting process, but you will have to deal with plating a part that has an essentially porous surface.

The most reliable and repeatable means of sealing porosity in the castings is through the use of electroless nickel in the preplate cycle. Electroless nickel at a thickness of 0.0005 in. will fill porosity and envelop the parts with a continuous coating. The electroless nickel protects the substrate by sealing it from the atmosphere rather than providing sacrificial corrosion. In addition, electroless nickel is known to be impervious to attack in industrial and marine environments. The following is a generic preparation cycle:

- preliminary cleaning (solvent degrease)
 - ✓ soak clean in non-etch cleaner
- rinse
 - ✓ etch clean in either an acid (preferable) or alkaline etch
 - acid desmut in a triple acid (sulfuric, nitric, hydrofluoric)
 - zincate (an alloy zincate is preferable)
- rinse
- rinse
- electroless nickel plate
- rinse
- Plate to desired finish

Although costs associated with processing will be higher, the use of electroless nickel will minimize rejects and increase the reliability of your parts.

Removing Fe & Cu From Hard Cr Baths

Q. What is the least expensive method of removing iron and copper from a hard chromium bath?

A. The term "least expensive method" is relative and assumes the method will be capable of removing the correct types and quantities of contaminants.

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There are three primary refining methods for chromic acid solutions that can remove positive cationic contaminants from chromium plating solutions.

The oldest, least efficient and least expensive process to purchase is a porous ceramic device that has an internal chamber equipped with an electrode. It is capable of separating some contaminants from the chromium plating solution. This process will handle solutions with low concentrations and low rates of contaminant buildup. Although it is relatively inefficient, its low purchase price allows more than one unit to be

employed. It also has the advantage of operating directly in the chromium plating solution.

A second method for refining chromic acid solutions employs an ion selective membrane that separates the catholyte solution from the rest of the plating bath. Positively charged cations (copper, iron, nickel, zinc, etc.) pass through the membrane and precipitate in the catholyte solution. This type of process may also be employed on the chromium plating bath directly and will remove large volumes of contaminants. It is, however, adversely affected by the fluoride in modern catalyst systems.

Last, but by far, not least, is the use of ion exchange cation resins to remove cationic contamination from

plating solutions. Ion exchange is usually employed as part of a reclaim system and removes contamination from dragout solutions returned to the chromium plating bath. This type of system will remove large quantities of materials from the plating solution, but will not do so on an ongoing basis. If the chromium solution is passed through the ion exchange resin at too high a concentration, it will attack the resin and make it unusable.

Titration Acid Copper Solutions

Q I have tried the acid copper analysis you recommended in the August issue of *P&SF* and found there is an error when titrating a solution that operates on non-ferrous substrates. Would you be interested in a successful method that I use daily?

A Walter Pyper of Keeler Brass writes of a successful method for titrating an acid copper solution that is used over zinc die castings without the error caused by zinc contamination.

1. Pipette a 2.0 mL aliquot of the acid copper solution to be analyzed into a 300 mL Erlenmeyer flask.
2. Dilute with approximately 75 mL distilled water.
3. Add 10 to 15 mL of 10 percent potassium iodide.
4. Titrate with 0.10 N sodium thiosulfate to a pale yellow color.
5. Add 1 mL of soluble starch solution, mix well and continue the titration to the disappearance of the blue color.
6. Calculate the copper sulfate concentration in the plating solution as follows: Copper sulfate ($\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$) in oz/gal = mL of thiosulfate X normality of thiosulfate X 6.7.