P&SF Retrospective

Originally contributed by Ronald Kornosky
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Based on an original article from the early Finishers Think Tank series
[Plating & Surface Finishing, **71** (4), 14 (1984)]

Electropolishing stainless

Q: ***How can I specify and control electropolishing on stainless steel? My products are cut out of 5/8-in.-thick plate with a fairly rough surface.***

A: The American National Standards Institute (ANSI), 1819 L Street, NW, Washington, DC 20036 (www.ansi.org) has a specification you could use. ANSI/ASME B46.1-2002, *Surface Texture, Surface Roughness, Waviness and Lay*, spells out roughness, waviness and other finish characteristics. It pertains to the geometric irregularities of surfaces, and defines surface texture and its constituents. It also defines parameters for specifying surface texture. The roughness height is indicated in microinches and represents the arithmetic average deviation of the surface from the mean line in a profile.

To start, you could specify a maximum surface roughness (*e.g.*, 16 microinches, rms or AA) and use a surface finish comparator for monitoring. To decide on the finish you want, ask a vendor to supply samples electropolished for 3, 6, 10, 15 and 20 min and select your preference. Or, you may choose to control overall appearance. In this case, ask a vendor to supply duplicates (or perhaps triplicates) of samples electropolished for time periods ranging from 2 to 20 or 30 min. Then provide each of your vendors with a sample of the finish you select and keep another for your inspector.

Coloring copper

Q: ***We have been experimenting with a "Tiffany Green" guidebook formulation for coloring copper-plated and solid copper parts. Why can't we get any color?***

A: The lack of color formation may be due to the development of a copper oxide film, which can normally be removed after alkaline cleaning using a 3 to 5% HCl dip. The other possibility is that the formulation requires that you expose the parts to a humid atmosphere (95% relative humidity), with no intermediate rinsing after dipping in the solution.

I'm sending you an article entitled "Colored Finishes for Copper and Copper Alloys", by the late William H. Safranek [*Plating*, **55** (12), 1255 (1968)], which suggests a multitude of processes, including slightly acidic dips, anodic treatments and even pastes. One of the anodic processes employs a 7 to 12 oz/gal (55 to 95 g/L) sodium bicarbonate solution operating at an anode current density of 80 A/ft^2 (8.6 A/dm^2) for 1 to 2 min. The coating resists mild abrasives and adheres to properly cleaned surfaces.

Silver activation

Q: ***What type of activation can be used for plating gold or rhodium over silver?***

A: A common cycle is cathodic treatment in an alkaline electrocleaning solution containing some free cyanide, followed by water rinsing, immersion in 10 to 20 vol% H_2SO_4 and an additional double water rinse.

A problem that may occur when plating rhodium over silver is a slight alkaline film left by the silver bath. If not removed, it could leave a "cloud" under the plating, since the most popular rhodium bath is a sulfate type containing sulfuric acid. Dr. Ron Morrissey of Technic, Providence, RI, says scratch brushing may be necessary prior to activation if the silver is heavily tarnished, particularly if rhodium plating is to be done.

Thickness measurement

Q: ***I need a non-destructive means of measuring chromium on 304 stainless steel. Any suggestions?***

A: The key word in your question that restricts the number of methods is "nondestructive." Eddy current would not be sufficiently precise because there is not enough difference in conductivity between the chromium and stainless steel. Beta backscatter depends on the difference in the atomic number of the metals and at least a 15 to 20% difference is needed. This method also is not advised for your application.

One answer is x-ray fluorescence. This procedure utilizes an x-ray beam to excite the layers, causing fluorescence that creates different peaks depending on the type of deposit and the thickness. These are relayed to a microprocessor which gives direct readout after proper calibration.

Formaldehyde analysis

Q: ***How do we analyze formaldehyde in sulfuric acid?***

A: According to Frank Altmayer of Scientific Control Laboratories in Chicago, the analytical method would depend on the concentration of formaldehyde. If it is in the ppm range and is the only organic present, a total organic carbon analysis can be used, but this requires expensive equipment [about $12,000 (in 1984 dollars - *Ed.*)].

If present in appreciable quantity, formaldehyde can be titrated with sodium metabisulfite:

1. Pipette 10 mL of acid containing formaldehyde into a 350-mL beaker and add 50 mL of DI water.

2. Add exactly 10 mL of sodium metabisulfite solution (12 g/L) and allow to stand 15 min.

3. Pipette a second 10 mL of metabisulfite into a 350-mL beaker and add 50 mL of DI water.

4. Titrate this second solution with 0.1N iodine solution to the first blue color with starch indicator. Call this “Titration A.”

5. Repeat Step 4 with the first solution, calling that “Titration B.”

6. Calculate as follows: A -B · 0.15 = g/L HCHO.

The edited preceding article is based on material compiled by Mr. Ronald Kornosky, then of Hager Hinge Co., in Montgomery, AL, as part of the Finishers Think Tank series, which began its long run in this journal 26 years ago. It dealt with everyday production plating problems, many of which are still encountered in the opening years of the 21st century. As we have often said, much has changed . . . but not that much. The reader may benefit both from the information here and the historical perspective as well. For many, it is fascinating to see the analysis required to troubleshoot problems that might be second nature today. In some cases here, words were altered for context.