Plating & Surface Finishing Retrospective

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Based on an original article from the early *Finishers Think Tank* series
[Plating & Surface Finishing, **70,** (5), 66 (1983)]

Calibration accuracy

Q: What is the recommended calibration accuracy for voltmeters and ammeters used in the plating industry? Is there a standard recommended procedure?

A: Generally, the meters furnished are within ± 2% accuracy [but much better in 2006]. With all the other variables in the finishing process, this is normally good enough. The usual procedure would be to have the manufacturer of the meter do the testing. The maker usually has a voltmeter or ammeter-shunt that has been calibrated and that can be directly traced to one at the National Institute for Science and Technology (NIST). Your meter is then returned with a chart to match its reading to the correct figures and with a certificate, if desired, that gives it traceability back to NIST. Note must be taken with ammeters that the same shunt is used with this method. Other than this, I know of no specification as such for accuracy. [For current information (2006), see http://ts.nist.gov/MeasurementServices/Calibrations/ - Ed.]

Silver on bus bar

Q: Would you please advise me on any standards or recommended practice for silver plating aluminum bus bars. Any references would also be appreciated.

A: One method of plating onto aluminum is the zincate process, usually followed by a copper strike over the zinc. Some success has been reported using an acetate-buffered nickel glycolate bath to replace the copper strike.[1,2] Another popular process calls for cleaning, desmutting and immersing the part into a stannate-based bath for immersion tin deposition, then a bronze strike. Many articles have been written on this subject. In addition, you might look into the AES Research Project 41 report and the book *Surface Treatment and Finishing of Aluminum and its Alloys*.[3]

Steve Schachameyer of Eaton Corp., Milwaukee, WI, reports as follows:

"Within the electrical industry, performance standards exist for each class of devices electrical manufacturers produce. These are generally U.L. standards for the product and not individual components of that product. All that a U.L. standard might say is that for a certain voltage rating, the bar must be plated with silver or tin without performance specifications of the plated aluminum bus. Each manufacturer of such devices has internal standards for such components.

"I would recommend your reviewing ASTM B-253.[4] From the same source material on silver would be available.[5] A combination of both specifications should allow you to properly specify and procure silver-plated aluminum bus bar.

"There have been articles written about plated aluminum bus bar, primarily in the "popular trade" literature. To search out some of these references, please refer to a paper entitled, "Evaluation of Improved Reliability of Plated Aluminum Extrusions."[6] References 3 thru 9 at the end of the article should be of particular interest." Mr. Schachameyer concludes.

References

1. L. Missel, *Plating & Surface Finishing*, **64** (7), 32 (1977).
2. L. Missel & G. Kishi, *Metal Finishing*, **79** (8), 37 (1981).
3. S. Wernick, R. Pinner and P.G. Sheasby, *Surface Treatment and Finishing of Aluminum and its Alloys*, *Vols. 1 & 2*, 5th Ed., ASM International, Materials Park, OH and Finishing Publications, Ltd., Teddington, Middlesex, UK, 1987; Reprinted 1996.
4. ASTM B 253-87 (2005)e1, *Standard Guide for Preparation of Aluminum Alloys for Electroplating*, ASTM International, West Conshohocken, PA, 2005 (www.astm.org).
5. ASTM B 700-97 (2002), *Standard Specification for Electrodeposited Coatings of Silver for Engineering Use*, ASTM International, West Conshohocken, PA, 2002 (www.astm.org).
6. S.R. Schachamayer, T.R. Halmstad & G.R. Pearson, *Plating & Surface Finishing*, **69** (10), 50 (1982).

Tin over electroless nickel

Q: I am attempting to tin plate some devices already coated with electroless nickel. All the acid prep solutions I have tried leave a black smut on the surface. Can you recommend a preplate process?

A: Electroless nickel deposited from an acid bath is extremely hard to activate for replating. The parts should be cleaned under mild conditions and then may be activated using cathodic treatment in 120 g/L (1.0 lb/gal) of most proprietary acid salts. Perhaps cathodic treatment in 10% sulfuric acid and a proprietary additive would work. Depending on how passive the surface is, a Wood's or sulfamate nickel strike may be needed. Details on the latter strike were presented by Don Baudrand of Allied-Kelite, Des Plaines, IL, in the December 1982 version of this column [recently reisuued in *Plating & Surface Finishing*, **93** (10), 24 (2006)]. One of these should do the trick.

Hard chromium

Q: Is chromium plate advisable for an application involving point contact fatigue (heavy load at point on rotating shaft)? If so, what procedure is recommended?

A: According to Dr. Edgar Seyb of M&T Chemicals Inc., Rahway, NJ, a high point load on a revolving chromium-plated surface is not usually considered advisable. While electrodeposited chromium has very high hardness, it is susceptible to crushing under high loads [tensile strength = 103 to 552 MPa (15,000 to 80,000 lb/in^2)]. Another question would be whether lubrication would be lost under the high point load, in which case galling would occur, comments Dr. Seyb.

For other purposes, hard chromium deposits will add surface hardness to a part if thickness is adequate. How much is enough is a good point to debate. Chromium deposits give a low coefficient of friction and good anti-galling properties. The hardness of the base material also has a bearing on the thickness desired. Over a soft substrate, greater plating thickness is required than over a hard material. If the substrate exhibits cold-working stress, proper baking before plating may be required. Remember that the finished surface will be affected by the original substrate condition, and that blasting, peening or polishing may be necessary.

A typical cycle for low-carbon steel would include: anodic alkaline cleaning; rinsing; etching anodically in a chromic acid solution; plating with hard chromium and rinsing. The chromium can also be polished after plating if necessary. ASTM Specification B-177[1] may help you to determine what is required to satisfy your future needs. Another pertinent specification is MIL-C-23422, covering wear resistance and anti-galling.[2]

References

1. ASTM B 177-01 (2006)e1, *Standard Guide for Engineering Chromium Electroplating*, ASTM International, West Conshohocken, PA, 2005 (www.astm.org).
2. MIL-C-23422F (Chg Date: 06/18/97), *Chromium Plating, Electrodeposited*, Document Automation and Production Service (US Gov't.), Philadelphia, PA, 1992 (http://assist.daps.dla.mil/quicksearch/).

Saltwater process

Q: Your assistance is requested to locate a published item relating to an electrolytic process. Low voltage, applied to wire mesh immersed in seawater, results in the deposition of material on the wire, thereby producing a material of considerable strength suitable for buildings, interior or exterior walls, or for reinforcing submerged pilings.

A: We have tracked down a potentially useful reference with the help of Fred Pearlstein, U.S. Navy Aviation Supply Office, Philadelphia, PA. The paper, "Considerations of Importance in the Cathodic Protection of Marine Structures," was presented by Kenneth G. Compton, *et al*. at the Corrosion '74 conference in Chicago (*Proc. Corrosion '74, Paper No. 120*). The paper is available from the National Association of Corrosion Engineers, Publications Dept., P.O. Box 1499, Houston, TX 77001 .

Anodizing for bonding

Q: Which is best for providing a good bonding surface - chromic, phosphoric or sulfuric acid anodizing? Also, what is your opinion of the "FPL" etch?

A: The FPL etch is a sulfuric acid / sodium dichromate bath and was developed about 30 years ago to achieve good bonding. In use, care must be taken not to overetch the surface, as this will have a very definite effect on adhesion. The obvious problem of waste treatment for the hexavalent chromium also is a factor. Several good papers on alternative processes were presented at the Society for the Advancement of Material and Process Engineering (SAMPE) 13th Annual Technical Conference and may warrant investigation for your application. Contact: SAMPE, 1161 Park View Drive, Covina, CA 91724-3751.

As for the anodized surfaces, Charlie Grubbs of Reynolds Metals, Richmond, VA, reports that very little work anymore is done with phosphoric acid anodizing as a base for adhesion. Of the other two, the chromic acid type generally would be preferred. It has inherent corrosion resistance, especially when the part has welds, rivets, etc. If there is any chance of poor rinsing, the sulfuric acid solution would be more likely to damage the bond than would the chromic acid solution. A primer over the anodized surface may not be needed either. If the work does not have to be anodized, a simple chromate treatment of the aluminum usually gives excellent adhesion. *P&SF*

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.