Advice & Counsel

Frank Altmayer, MSF, AESF Fellow AESF Technical Director Scientific Control Laboratories, Inc. 3158 Kolin Ave. Chicago, IL 60623-4889 E-mail: faltmayer@sclweb.com



Now You See It—Now You Don't Rapidly Dissolving Anode Baskets Are Cause for Concern

Dear Advice & Counsel,

I am relatively new to plating, as my company completed the installation of an automated barrel plating line about three months ago. All we do is chloride zinc plating, at very high volumes.

I am concerned about the titanium anode baskets, which seem to be dissolving at a rapid pace (see photo). We just placed an order for new ones, but I'm afraid it will happen again, unless we find out what is going on. Please help.

Signed, Losing It

Dear Losing It,

We visited your facility, inspected the plating equipment and discussed the operation of the plating line.

The plating tank is operated with individual rectifiers on each barrel station. The rectifiers are software-controlled to operate in "constant current" mode. This means that the voltage on a barrel is automatically increased to compensate for changes in resistance (such as a variation in load size). We noted that plating voltages presently employed ranged from 11 to 16+ volts (topped out). The highest voltages were on cells that had already experienced severe attack of the titanium (although this was probably caused by the absence of much metal for conduction, after the basket etched away).

The titanium anode baskets are protected from dissolution by the fact that they are filled with zinc, which dissolves and galvanically protects the titanium. However, if the baskets are not filled religiously, or if a "bridge" forms within the basket (basically zinc that has dissolved in the middle of the basket, but the anode balls refuse to settle), then the titanium is prone to be etched.

Titanium resists dissolution in acidic solutions by an oxide film that forms when DC voltage is applied in the range of 0-10 volts. If much more than 10 volts is applied, the oxide film may be unstable or will not form. In the absence of zinc, a chloride containing solution may produce chlorine gas at the anode basket surface.

Further Investigation Needed

We are not sure why your plating solution requires such a high operating voltage and this needs to be investigated. One possibility is the larger distance between the anodes and the barrel load. At the present time, the plating solution is contaminated with white milky solids that are a combination of titanium oxide and zinc hydroxide, which may cause some of the extra resistance that the solution currently exhibits.

"By reducing the distance between the anode and barrel by 50 percent, the voltage should drop as much as 30 percent, which may bring the applied voltage below 10."

The following should be considered:

- Titanium baskets should not be operated at voltages above 10. The solution and or equipment must be modified to change this condition.
- 2. One equipment change that we can recommend is to move the anode baskets much closer to the barrels. By reducing the distance between the anode and barrel by 50 percent, the voltage should drop as much as 30 percent, which may bring the applied voltage below 10, once the damaged baskets are replaced.
- 3. The rectifiers must be equipped with an alarm system to notify the operator any time the voltage exceeds 10 volts. This would provide guidance that would



Titanium anode basket.

avoid attack of the baskets. An alternate would be to operate the rectifiers in constant voltage mode, but your plating thickness coming out of the line will not be as uniform.

- 4. The anode baskets must be maintained in the "full" condition. Bridging may be detected by tapping the anode balls with a plastic rod, or by going to a smaller ball size.
- 5. If the equipment/solution can not be modified sufficiently to operate at voltages below 10, then titanium baskets can not be used and slab zinc anodes are the only alternative. Slab zinc anodes are undesirable because they change dimension as they dissolve, and on this plating line, changing slab anodes on the far walls is very difficult.
- 6. The operating voltage on the plating solution can be minimized by keeping the chloride content of the plating solution at the high end of the operating concentration range. *P&SF*