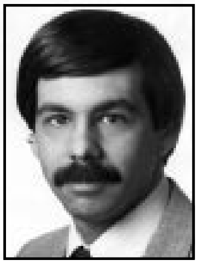

Finishers' Think Tank

Marty Borruso
26 Flagship Circle
Staten Island, NY 10309
Phone: 1-500/FINISH1
Internet: dpjh50a@prodigy.com

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Pollution Prevention

Q. **We deposit nickel and chromium on brass and copper substrates. Although we recover the plating rinses, we are using too much water in the cleaning cycle. How can we conserve rinsewater in the preplate and close the loop on the entire line?**

A. Rinsewater in the cleaning cycle offers some interesting opportunities. When working with brass and copper substrates, it is important to recognize what contaminants get into the cleaners and rinses, and what is necessary to remove those contaminants—or keep them at a steady state—so that rinsewaters and process solutions can be recovered.

The preplate cycle you are currently using is the following:

- Soak clean (to remove machine oils and greases)
- Electroclean (to remove surface smuts and soften annealing scales)
- Acid pickle (to remove scale and oxides and prepare the surface for plating)

Cleaners generally run hot (140–180 °F) so that they have a high level of evaporation. Low-foaming surfactant in the cleaners, as well as air agitation, will encourage evaporation and recovery of the rinses. In the cleaners, the contaminants are metals (copper and zinc), oils and greases. Copper can be removed by electrolysis; the zinc, however, will not normally plate out of the cleaner solution. Although the zinc concentration will build up in the cleaners, it probably will not interfere with the process ability.

Oils and greases may be removed by ultra- or nano-filtration, or by the use of a de-emulsifying agent to remove the organic materials. The rinses may then be returned to the cleaners at a decent rate—without the use of outside equipment (*e.g.*, evaporators)—so that much of the rinsewater can be recovered.

Acids also can be recovered by electrolytic methods. There are several high-efficiency process systems that can perform this process. The only contaminants that will be found in the acids should be metals—once the metals are removed, the acid is fully functional. As mentioned earlier, zinc is not efficiently removed by electrolytic recovery, but the levels must go fairly high before interference is noted.

Once the solutions are set up for recovery, the flow of rinsewaters can be managed through reactive rinses. These acid rinses are used to rinse the cleaners from the parts, as well as to increase the efficiency of rinsing from the cleaners.

Non-silicated cleaners should be used, because silicates can precipitate onto the surface of the parts and prevent good adhesion of future deposits. Only mineral acids and mixtures of mineral acids should be used so that the recovery is efficient and the components identifiable.

Reactive rinsing will reduce the amount of water used, and will also increase the efficiency of the rinsing. Recovery of the cleaner rinses, in coordination with purification of the cleaners, will allow not only for double use of the water for rinsing, but also for recovery of part of that water. The first step, however, is to identify and implement the purification and recovery plans, followed by a focus on water use at the facility.

Copper Buildup on Plating Racks

Q. **What is the best stripping method to remove copper buildup from plating racks?**

A. The best method for removing copper from plating racks is not to get the copper deposit on the racks in the first place! If you are building up copper on the surface of the fixtures, it is important to design racks that don't allow for such buildup. First, repair or replace racks to minimize the amount of copper that can deposit on them. Then, if you still get plating on the racks, there are various strippers you can try.

The traditional method is to use nitric acid to dissolve the extraneous deposits from the racks. This only works, however, with stainless steel rack tips, which don't get attacked by the stripping solution. With copper racks (or unprotected areas on racks), nitric acid will attack the rack structures. Also keep in mind that nitric acid involves personal and environmental hazards—it is highly corrosive and dangerous to handle. Disposal of the spent nitric also presents a problem. It should be either recovered at the site or sent to a secondary reclamation facility.

If the racks are coated with only copper or other individual metals, the spent nitric acid can be sent out for recovery and reclamation. The cost of reclamation itself, therefore, might be offset by the intrinsic value of the copper or other metals recovered.

Another method of stripping the copper is through the use of electrolytic rack strippers. These stripper materials should be coordinated with the original rack manufacturer, to ensure that the chemistry of the stripper doesn't attack the racks. With properly maintained chemistry, the bath will plate out at the same rate that materials are brought into solution. If the right balance is maintained, the recovery will be efficient and the solution will last forever—there will be no net environmental or disposal effect.

Tank Size Considerations

Q. We use two tanks to deposit silver to thicknesses of up to 5-thousandths. The larger tank usually gives a good, level deposit with fine grain. The chemistry in the larger tank is the same as in the small tank; however, deposits from the small tank are usually rough, with an open grain. Why is there such a difference and how can we minimize the disparity?

A. If the chemistry is truly the same in the two tanks, there are some physical reasons that can cause this kind of difference in the deposits. The current that is applied in the system may be too high for the plating solution. When determining current density, you must consider both the anodic and cathodic side of the process tank. If the current density on the anodic side is too high, there will be oxidation of the cyanide and additives in the bath, which may yield roughness and poor-quality depsoits.

The size of the tank and the solution reserve must also be adequate to allow for the jobs to be performed with little or no change in the bath chemistry. Changes that occur during the plating process are an indication that the tank is too small for the job. If you find you are making additions to the tank during operation, the tank is too small, and keeping the bath at operational levels is almost impossible. Although problems may be encountered because a tank is too large for the jobs being run, with low-efficiency systems, problems will arise more often when the tanks are too small. Always be as precise as possible when sizing a system, so that it is appropriate for the job.

Chromate Coating on Zinc

Q. We barrel plate commercial zinc, with a customer requirement for a clear chromate coating that will withstand 16 hr to white rust on the parts. We are having difficulty maintaining this on a consistent basis. What can we do to correct the problem?

A. A requirement of 16 hr to white rust on zinc-plated and clear-chromated parts is not unreasonable. If you are not making that specification, perhaps you are not really achieving a chromate coating at all.

The use of the term “clear” is ambiguous, because it is usually used to describe a blue-bright chromate, which is derived from a chromate emulsion and becomes an integral part of the surface of the parts as a conversion coating. The other possibility is a “white” clear chromate, which is not a chromate at all, but a passivate that will offer minimal protection. If this is what you are getting, the 16 hr requirement may be a hurdle you cannot overcome.

The first step is to look at your pretreat operation to see if you are properly preparing the surface of the base metal for plating—that it is free from soils or oils that could interfere with the deposit of the zinc. The next step is to evaluate the descaling process. Are you completely removing the rust scale and smut that is inevitably left on the surface after cleaning? The last step before chromating is the zinc deposit, which is a clean solution with little, if any, metallic or organic contaminants. If you find contaminants, then your problem may be between the zinc and the chromate.

The final area of concern is the operation of the chromate itself. If the pH is too low, you will get good polishing, but no real protection from the chromate—the trade-off between polishing and protection. If the chromate is operating properly, then there is something intrinsic in the configuration of the part and how it reacts to chromating. A post-chromate sealer, such as an organic coating or a silicate, seems to bring the salt spray response to fairly high levels. Using silicates for protection will also allow for the use of blue-bright chromates. Leaching the color with the mildly alkaline silicates will leave a clear protective film that will withstand the 16-hr salt spray specification—in fact, it should far exceed that expectation. ***P&SF***