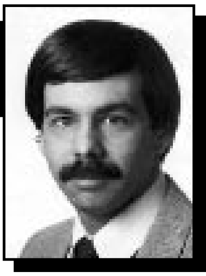

# Finishers' Think Tank

Marty Borruso • 26 Flagship Circle • Staten Island, NY 10309
Phone 718/876-4943

*Have a problem on the finishing line? To send your question, use the convenient, postpaid form on our Readers' Service Card, or send a letter to:* Finishers' Think Tank, *12644 Research Pkwy., Orlando, FL 32826-3298.*

## Cyanide Consumption Increase

**Q. Every Spring, it seems as if the cyanide consumption in our brass plating process almost doubles, for a period of about a month. Can this be caused by the excessive chlorination of the city water during these times? What can be done about it?**

**A.** As the level of chlorine increases in a cyanide plating solution, so do problems associated with that increase. Chlorine is used in most municipal water supplies to reduce the growth of bacteria and algae in the water supply system—this is the positive side. In a plating operation, however, high levels of chlorine in the incoming water supply can yield numerous problems.

A company in eastern Pennsylvania, for example, encountered a problem with roughness in its nickel deposit at certain times of the year. Although the solution was adequately circulated through a filter, when the rinsewater was recycled, roughness resulted. That problem was traced back to the water supply—in particular, to the level of dead bacteria in the system.

Chlorine is anodic in nature, and will migrate to the anode as the plating solution is electrolyzed. At the anode, the chlorine is oxidized to hypochlorite, which causes an accelerated chemical breakdown of the cyanide in the plating bath. Because the solution is alkaline, the hypochlorite will be absorbed into the plating solution and will remain there until it reacts with cyanide, producing a reaction product that is probably a useless form of a cyanate compound.

Another problem that is occurring—and one you may not be aware of—is the degeneration of steel anode baskets, caused by the introduction of chlorine in the plating solution. This will create a two-fold problem: First, by decomposing the baskets, affecting their strength and usefulness; and second, by dissolving iron into the plating solution, forming ferrocyanide compounds that are difficult to treat in the waste process. These residual iron-cyanide problems will be apparent for the life of the process solution, so that an effect generated today will cause a problem for a long, long time, thereby increasing the cost of treatment in most areas of the U.S. that require second-stage cyanide treatment.

The best "cure" in this case is prevention. Different techniques can be used to remove chlorine from the water supply before it reaches the plating line, which is the main objective. Anionic ion exchange resins supply the most complete answer to the problem of ridding the system of unwanted chlorine.

As the industry continues to reclaim and reuse rinsewaters and to minimize discharge from plating lines, it must examine ways to purify materials entering the systems. Plating solutions are no longer dynamic, changing processes—they are becoming stagnant collectors of all that enter the system. The best purification, therefore, is prevention.

Once the areas that can be controlled by in-house techniques have been identified, suppliers should be contacted to obtain typical analyses of impurities that exist in the additives being purchased. What was an acceptable purity level when the environmental standards addressed end-of-pipe treatment of discharges, is not acceptable today when pollution prevention techniques are employed to recover and reuse rinsewaters—techniques that keep those materials in the process systems.

## Electrolytic vs. EN Over Aluminum

**Q.** What is the difference between results from an *electrolytic* and *electroless nickel* deposit over aluminum?

**A.** In general, nickel does not plate directly onto the surface of aluminum with standard systems. It is normally deposited with the use of an alkaline zincate solution, which coats the aluminum surface with either zinc or a zinc-based alloy. After the zincate film is deposited on the aluminum surface, it may then be plated with either electrolytic or electroless nickel.

The main difference between the deposit of electrolytic and electroless nickel is associated with the initial mechanism of deposit for each, as well as the way in which the deposits deal with the zincate coating.

*Electrolytic nickel* may deposit directly over the zincate coating, or directly over an initial copper coating deposited over the zincate to protect the surface before nickel plating. Most newer alloy zincates will allow the direct over-deposit of nickel from a Watts bath. This is preferable, because copper will interfere with the corrosion characteristics of the deposit, which can cause the coating to be prematurely undermined.

Plating over a zincate deposit will cause it to be subject to any porosity in the deposit, causing an accelerated corrosion laminar through the zincate layer. Such an "attack" on the zincate interply causes lifting and premature failure of the part being processed. Because nickel protects aluminum cathodically—by sealing the part from the environment, rather than by sacrificial corrosion—the part will be liable to any porosity in the surface as potential points of failure.

*Electroless nickel*, on the other hand, removes the zincate interply and deposits the nickel directly onto the aluminum surface. It does this, first, by a simple substitution reaction replacing the zincate, and, second, by an autocatalytic process to build up nickel thickness on the surface, resulting in no zincate layer residue on the part. Electroless nickel is also amorphous in structure, and will help seal the porosity of the aluminum surface, if properly prepared.

The corrosion resistance of electroless nickel is well-known and documented. If the porosity of the surface is properly treated, then the surface is fairly immune to attack in most atmospheres. The two main problems associated with processing aluminum—corrosion resistance and adhesion—may both be obviated by the use of electroless nickel for at least the first layer of plating on an aluminum substrate.

❖❖❖

**Shop Talk from Marty ...**

*Pollution Prevention—Economic Drivers for Implementation Of Pollution Prevention Programs In the Metal Finishing Industry*

As an industry, we must be able to compete in the worldwide marketplace. Our competition has the ability to reduce costs associated with metal finishing by either loosely enforcing regulatory requirements, or by not having requirements at the same level as we must contend with in the U.S.

The essential cost differentials that must be minimized in the U.S. are three-fold: Labor, energy, and environmental issues. Labor can be made more productive by automation and training. Energy can be applied more efficiently and used to the utmost. That leaves the issue of environmental compliance.

The metal finishing industry has always considered compliance an end-of-pipe "cost sink" that removes profits from the industry's bottom line. To compete wisely, we must change the paradigm that we have operated with for many years, and look to the application of pollution prevention techniques and programs as *economic drivers*, to allow for more economic operation of our plants and facilities. Operations that employ such techniques will truly add to their bottom lines.

Undergoing an appraisal process will reveal changes that can be made, not only for the quantity and quality of discharges, but for integrating those changes into the ever-growing quality programs that have been so readily accepted by the industry. Current, conventional wisdom has dictated that "best available technology" be installed to treat the discharges produced by the metal finishing industry. That statement can be interpreted to mean that we must procure chemicals and supplies to use in our processes, and a portion of what we buy must be treated and discharged.

Waste from metal finishing operations involves materials that escape the production process and flow into the treatment systems for final disposal. Focus has always been on the best—and most efficient—way of treating and discarding those waste materials. Pollution prevention now asks that a similar amount of technology and attention be paid in the non-production of waste. This is accomplished in the production process and at the production level—in the design of process flows that reduce and eliminate the production of waste materials. Process conservation and recovery techniques that accomplish a payback of investment will forever remove waste as a cost issue, because what we are recommending are process systems that do not allow for the discharge of waste materials.

In examining the economic consequences of our actions and production systems, pollution prevention can be used as an engineering imperative to accommodate changes that will help justify these programs on an economic basis, and allow for implementation with true payback expectations.

The areas to be concerned with are those that will increase quality and reduce effluent from process systems that present a discharge of valuable company resources as waste materials. ❑