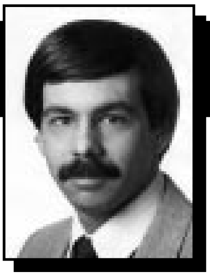

Finishers' Think Tank

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Cyanide Copper Strike

Q. When we operate cyanide copper strike solutions, we sometimes experience pH changes in the copper strike. Why is this happening, and what can we do to prevent the pH changes?

A. In alkaline cyanide plating solutions, it is imperative that there is a good distribution of both soluble and insoluble anodes—or no insoluble anodes at all. Insoluble anodes work at low efficiency. Because of this fact, they tend to increase the pH of the process systems through the evolution of hydroxide at the anode surface in alkaline plating solutions. With inefficient plating solutions, therefore, the pH tends to increase.

The use of soluble anodes with a chemically well-controlled process system should correct the problem of the increasing pH. It is also important that the anodes do not develop a passivation film. A coating on the anode surface will also decrease the efficiency of the anode surfaces, which causes them to react much in the same way as insoluble anodes—by increasing the pH of the process system. As a rule, it is best to keep a fairly high concentration of tartrates in the plating solution to keep the anodes working at maximum efficiency, and to keep the conductivity high in the solution so that it can be run "lean."

If, however, the pH is still not under control after using the right amount (2:1 anode-to-cathode ratio) and the right configuration of anodes, try adding small amounts of bicarbonate to drop the pH to acceptable levels.

Brass-flashing Over Nickel

Q. We are brass-flashing over nickel and are experiencing some problems with color changes after coating and baking the water-reducible lacquers. The brass formulation is standard textbook, except that it has a nickel contamination of greater than 500 ppm. What is causing the problem and how can it be corrected?

A. Nickel in a cyanide solution is a real problem. In brass, it will make color-control difficult and will cause streaks and color changes upon standing—especially on high-temperature curing of the coating. The resulting color difficulties usually begin at about the 100 ppm level. It is noteworthy that you are able to control the color of the deposit at such high contamination levels.

The conventional wisdom has been to make additions of complexing agents to tie up the nickel and prevent it from causing the problem. This kind of treatment, however, is only effective if the post-treatment is mild. If the post-treatment heats the parts >150 °F, there will still be a color change.

A method for nickel removal from brass solutions that has met with limited success is the electrolysis of the plating solution at a high-cathodic current density (~ 40–60 Aft^2). Analytical results show a reduction of the concentration of the nickel, but to bring it down to acceptable levels (<100 ppm), this treatment may be too time-consuming and too ineffective.

The problem has become more acute in recent years, as industry strives to offer the marketplace better and more tarnish- and corrosion-resistant coatings. The majority of the advance coatings over brass (generally clear coatings) require temperatures for curing >300 °F. At these temperatures, the integrity of the brass plating is seriously tested, and most contaminants will demonstrate problems.

Brass plating solutions to serve aggressively post-treated process systems will be essential to operational reliability. Filtration and maintenance will have to be professionally executed, and the chemical parameters must be strictly enforced.

One method of keeping nickel out of the plating process is through the use of ion exchange, or reverse osmosis, to purify the rinse tanks between the nickel and the brass. If plated parts are kept on the racks—where they don't fall into the brass dragover of the rinse tanks—most of the problems with nickel contamination in brass plating solutions could be avoided.

If the process solution in your facility is too far gone to be purified, the only timely option may be to send it out to be treated and disposed of at an appropriate facility.

Q. Are there replacements for copper, nickel, and hexavalent chromium that will give the same kind of corrosion-resistant results?

A. That is an interesting way to pose the question ... so let's consider some interesting responses. Yes, there are coatings that will give as good—or better—results, depending on the application, as the traditional copper-nickel-chromium systems. They are, however, far less common or understood.

These alternate systems are not widely used, partly because they *are* uncommon—there are no major lines running in industry to produce large quantities under controlled conditions. New technologies, as well as new applications of established products, traditionally are "trailblazed" by smaller companies in discrete markets, on discrete products. Companies in the early stages of development of these coatings are not driven, therefore, by the larger market demands of either automotive or aerospace. For the same reason, the results produced by these companies may not be acknowledged by those relatively giant markets.

Alternative coatings are interesting to platers as a replacement to traditional coatings for two major reasons: Economy and environment. Hexavalent chromium operations present a problem to the environment because of the air and water effluent impact. There is also an OSHA consideration for those who come into personal contact with the operating process tanks. Operation, therefore, is problematic and costly.

One approach to uncommon coatings is to use a performance-based specification when writing new specifications. Alternate coatings could then be employed on some of the more common applications, establishing a database and earning respectability. Platers could then be more creative in their approach. One problem has been that, when suppliers discover that they have an alternate coating, they immediately try to convince a major industry to use the substitute—usually when it is too early in the development of the process. The track record, therefore, is not good, and new technologies get a bad reputation. The safety and security of common coatings with a large database is difficult to ignore for an application as huge as automotive.

Let’s consider some of the automotive issues. First, alternative coatings must significantly exceed, or at least meet, the current specifications for corrosion resistance. Second, they must be similar in appearance to a nickel-chromium finish. The public’s understanding of quality equates to a bright chrome appearance. Although this is significantly less important, alternate coatings must be able to blend in with the traditionally accepted coatings. Third, a complete database must be established for candidate coatings, with both pros and cons specified.

Another problem encountered when introducing new technologies is that the cost of *technology* development will pale in comparison with the cost of *market* development. Products tend to go on the market before they are ready, and this can be avoided by working through industry associations and by introducing the product in a smaller, not-so-demanding application.

There are systems and process sequences today that can match the color and meet the corrosion resistance requirements of standard coating processes. The acceptance of these products for trial under standard applications, however, is arduous and complex. The industry must try to get performance-based evaluations of coated products and establish a full database on the associated alternative systems. In order to be more competitive worldwide, it is imperative to remove the liability of some of the more hazardous systems by replacing them with more benign processes. It will take a great effort, but the rewards will be even greater.

Shop Talk From Marty ...

Pollution Prevention: Evaporative Recovery Techniques

Vacuum evaporators were one of the first technologies employed by the metal finishing industry to recover plating chemicals from rinsewater. As a result, evaporators are one of the more common recovery techniques.

Vacuum evaporators were the first to appear on the market, and one of the initial uses was on hexavalent chromium. The main problem was the partial insolubility of the chromium catalysts. The catalyst would “salt-out” and plug the tubing. Working hand-in-hand with the suppliers, soluble catalyst systems were developed and employed. Vacuum evaporators work well for these applications, but they tend to be expensive and complex to operate. They have been used on brass and other cyanide systems, but the maintenance is very intensive, and results tend to be ambiguous.

A vacuum evaporator is a distilling device that vaporizes water at low pressure under a vacuum. Evaporators work on the principle that, when a vacuum is applied, the boiling point of a liquid decreases (*i.e.*, solution will boil at a lower temperature). Rinsewater entering the system is concentrated, and returned to the plating bath to recover the plating solution assets.

Vacuum evaporators are especially useful when operated on temperature-sensitive plating solutions, when a high temperature causes a degradation of the process solution. They are also useful when a controlled amount of evaporation is warranted, and the company is located in an area of high relative humidity, which causes the inefficient operation of the atmospheric systems.

“Pros” on vacuum evaporators include: Consistent evaporation rate; effective on low-temperature solutions; and ability to handle a wide variety of solutions. “Cons” include: Systems are complex; they work on other than atmospheric pressure; and require high, fairly professional maintenance. ❏