A New Zinc Chloride Electroplating Bath

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High temperature zinc chloride baths have been available for several years, yet many platers have yet to adopt this technology. For barrel plater, significant productivity gains can be achieved by modifying the parameters of the traditional zinc chloride plating solution. High temperature zinc chloride solutions will make a line more productive. This chemistry also produces positive improvements to the properties of the zinc deposit. This paper will explore several real world examples of this chemistry in action and how it has benefited the bottom line of several platers. Necessary line modifications will be defined and the economic benefits of running this type of chemistry will be presented.

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Introduction

Chloride zinc is the workhorse of the zinc electroplating industry. Attributes such as a bright deposit, ability to cover difficult substrates, and easy waste treatment have made chloride zinc a reliable, cost effective coating for a wide range of industries. Many electroplating shops throughout the world rely on chloride zinc as a consistent profit center.

Unfortunately, through the years, chloride zinc has become a commodity item. Zinc plating shops have become comfortable with the steady day-to-day operation of this process. Global pressures have driven down the cost of chloride zinc but platers have been slow to adopt a newer technology chloride zinc which will increase the profits from these lines

High temperature chloride zinc chemistry has been proven in the field. This chemistry boosts the profits generated from a barrel chloride zinc line. By changing the proprietary chemistry and some operating parameters, barrel zinc lines will generate 10 – 40% more revenue. The revenue increase can be obtained by either increasing load sizes or increasing the number of barrels per hour.

The benefits in a rack bath are not as dramatic. Still, rack baths have seen faster low current density coverage. This translates into less time needed in plating to put enough zinc in the low current density area to survive a chromate.

Proprietary Chemistry

The high temperature chloride zinc plating baths require an upgrade in the proprietary package. The upgrade allows the package to stay in solution at higher temperatures while minimizing an increase in brightener usage. The conversion to this chemistry is always handled on a slide-in basis. The bath never has to be dumped. If the bath has a cloud point below 130°F, a treatment with carbon or potassium permanganate and thorough filtration will be necessary.

Installation

Besides the change in proprietary chemistry, the plating line needs some additional alterations. The new technology operates best between 110° and 125°F. Therefore, some means of heating the bath must be available. Once the bath is running, the heat generated from the current in a barrel line may be sufficient to keep the bath hot.

Barrel load sizes can be increased anywhere from 10 to 30% with the new system. Amperage increases from 20 to 50% will be required by the new system. The rectifier must be large enough to handle the additional load sizes or amperage increase. If the current rectifier is already running at full capacity, one will not be able to handle this new technology. An alternative to

increasing the load size is to increase the number of barrels per hour. This increase will require additional programming and possibly the installation of another hoist.

Third, the cleaning on the line must be very good. With these baths running at 115°F, drag-in of organic contamination will quickly lower the cloud point below the optimum temperature. Bolster the cleaning by investing in some of the newer technologies available for removing the oils from the cleaners. Filtration, skimmers, and coalescing units, are examples of technologies that can be employed. Counterflow rinsing is essential to obtain acceptable water quality for water carried into the plating bath. Additionally, an inhibitor in the pickle bath will reduce the build-up of iron in the plating solution. Up barrel rotation before the plating bath will reduce the iron drag-in and the organic drag-in.

Performance Increases

Once the line is converted to the new chloride zinc technology, the benefits are fast and dramatic.

Example 1

One manufacturer had been producing ten barrels per hour at two hundred twenty five pounds of parts per barrel. Once the new plating technology was installed, the manufacturer was able to increase the load size to two hundred and seventy five pounds, a twenty-five percent increase. The amperage per barrel increased from 520 amps to 675 amps. This amperage increase was easily handled by the rectifier already in place.

The revenue increase from this fifty pounds amounted to $415.00 per shift, assuming pricing is $0.1 per pound. Over 255 days, the revenue increase amounts to over $100,000 per shift.

Example 2

A second plating shop increased the speed of the machine going from 10 to 14 barrels per hour. The gross revenue increase from this option was in excess of $150,000.

Even though the plater had initial expenditures for reprogramming and refurbishing the cleaning on the line, they were able to eliminate a second shift. The entire cost savings are estimated to be about $250,000 over the first year.

Additional cost savings will be realized from the elimination of chillers. The ability of this system to operate at higher temperatures makes the need for cooling obsolete. Waste treatment costs have also been reduced when this system is combined with an evaporator. Solution build-up has been eliminated in the winter months with the combination of these technologies.

Example 3

Rack platers have been able to speed lines because of the ability of these systems to put zinc into the low current density areas faster. A plating shop was allowing 30 minutes for rack parts that were to be black chromated. After, switching to the high temperature technology, the plating time was reduced to 25 minutes with no stripping back of the lows. The reduction of plating time allowed the plater to pull between one to two extra racks per hour. The increase in production amounted generated an additional $12,000 over a ten month period.

Zinc Cobalt Alloy Benefits

This new chemistry has allowed lower levels of cobalt in the plating bath without decreasing the percentage of cobalt in the deposit. Both wet chemical analysis and electron microscope testing have been used to confirm this observation.

A second improvement with this alloy is that incidences of "cobalt burn" have been significantly reduced. The observation is based on the decline of the reject rate for this defect from 5% to less than 1%. The increase in load size reducing the overall current density coupled with less cobalt in the baths reduces the incidence of the burn.

Deposit Properties

Additional beneficial deposit properties have been confirmed with the high temperature chloride zinc systems. Chromate adhesion has significantly improved at sites where chromate adhesion was an intermittent problem. The mechanism for the improvement in adhesion is a better mechanical bond between the chromate conversion coating and the zinc-plated surface. This reduction in rejects is another cost savings that one is not immediately aware of until someone mentions how that adhesion problem has disappeared.

Ductility has also been improved in the zinc deposit from these systems. The reject rate at a plant that manufactures hose couplings has been decreased 75% after the new plating system was installed.

Related to the improvement in ductility, is the elimination of stardusting on fastener work. These systems do not exhibit any stardusting after the solution has been fully converted. The elimination of stardusting has proven to be a good selling tool to several platers.

Conclusions

A new zinc chloride technology is on the market that has proven to increase revenue from barrel lines up to 50%. This new chloride zinc plates faster into the low current density areas. This feature coupled with the ability of the system to minimize the distribution disparity common with conventional chloride zinc, allows the plater to reach minimum thicknesses faster or to increase load size and reach minimums in the same amount of time. (See Figure 1)

UNIFORM PLATING DISTRIBUTION

The test data on a seven-inch bolt (similar to the sample provided) shows that from the bolt head to the threaded end, SmartZinc plating is uniform.

FIGURE 1

The importance of this development cannot be overemphasized! By building thickness in the lows at an increased rate, zinc barrel line's revenues can be dramatically enhanced. In some instances, a second shift can be eliminated with no loss of production.

The new technology has also shown improvements in chromate adhesion, ductility, and the elimination of stardusting. Benefits have also been observed in zinc cobalt deposits. Less cobalt is required in the solution and "cobalt burn" has been greatly reduced.

With the ever shifting landscape of the global economy, systems which have proven to provide a competitive edge must be employed. If you haven't looked at high temperature chloride zinc, call your supplier and discuss the advantages with them.

