A New Zinc Chloride Electroplating Bath

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A novel zinc chloride electroplating chemistry is now on the market that boosts the profits from zinc chloride barrel baths. Barrel platers can realize significant productivity gains by modifying the parameters of a zinc chloride plating solution. This new chemistry also produces positive improvements to the properties of the zinc deposit. This paper will explore several real-world examples of this new chemistry in action. 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. Not much has been done to significantly improve the chloride zinc plating process in the last fifteen years.

Last year, new chloride zinc chemistry was proven in the field, which 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.

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 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 120°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.

Deposit Properties

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)

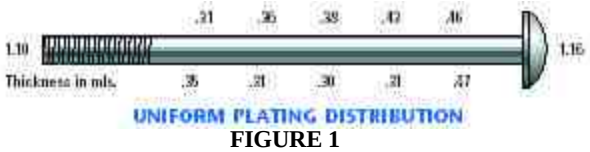

FIGURE 1

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.

Additional beneficial deposit properties have been observed in the short time this new technology has been in development. Chromate adhesion has significantly improved at test sites where chromate adhesion was an intermittent problem. The mechanism for the improvement in adhesion is still under investigation. However, preliminary testing indicates a better mechanical bond between the chromate conversion coating and the zinc-plated surface.

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.

Performance Increases

Once the line is converted to the new chloride zinc technology, the benefits are fast and dramatic. One manufacturer had been producing ten barrels per hour at two hundred 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 fifty pounds, a twenty-five percent increase. The amperage per barrel increased from 500 amps to 650 amps. This amperage increase was easily handled by the rectifier already in place.

The revenue increase from this fifty pounds amounted to $400.00 per shift, assuming pricing is $0.1 per pound. Over 255 days, the revenue increase amounts to over $100,000 per shift. (See Table 1)

TABLE 1

Table 2

A second example uses an increase in barrels per hour as a revenue-generating tool. The conditions are the same, however instead of increasing the load size; the plater opted to increase

the barrels per hour from 10 to 14. The gross revenue increase from this option was in excess of $150,000. (See Table 2)

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 can 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. Testing will continue into summer, as the higher humidity levels in summer lessen the effectiveness of the chiller.

Zinc Cobalt Alloy Benefits

This new chemistry is now under trial on a chloride zinc cobalt alloy line. Some early testing indicates the amount of cobalt in the plating bath can be reduced without a decrease in 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.

Conclusions

A new zinc chloride technology is on the market that has proven to increase revenue from barrel lines up to 50%. This new technology increases the rate of zinc deposit in the low current density areas, allowing the plater to increase the load size or increase the amount of barrels pulled per hour.

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.