Improving Your — Chloride Zinc Plating Operation _

By Stephen Schneider

Learn to recognize problem areas, then swiftly institute corrective measures.

If you are plating with a chloride zinc solution, you are likely enjoying the benefits of cyanide elimination, improved bath efficiency, and exceptional brightness. As with any plating system, however, you are probably encountering one or more routine operational problems and taking them for granted.

The root causes of, and practical solutions for, five common problems

associated with chloride zinc plating are addressed here. The problem areas are solution "growth," deterioration of titanium anode baskets, brightener oilout, color chromate adhesion, and treatment and removal of iron from the bath.

Solution Growth

Due to the wetting agents in a chloride zinc bath, the plating solution will shed better than the rinsewater that's dragged in. This results in a growing volume of plating solution. To minimize or eliminate this problem:

1. Add an approved wetting agent to the acid pickle to reduce surface

tension and increase rinsewater shedding.

2. Increase the dwell time and/or barrel rotation rate above the rinse so that more rinsewater will shed prior to the plating stage.

3. Use the same rinse tank for dragout and drag-in. With this setup, the dragged-out plating solution reduces the surface tension of, or "wets," the rinse.

4. Use an atmospheric evaporator activated by a solution level control (Fig. 1). Depending on the prevailing humidity, at room temperature these units will evaporate 5 to 15 gal/hr, which will more than compensate for



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solution growth. A low-foaming bath must be employed.

Two additional benefits of evaporators are that they treat iron through aeration and they cool the bath to reduce or eliminate the need for cooling water or chilling.

Basket Deterioration

In barrel lines, high voltage or an insufficient quantity of anode balls will result in the deterioration of titanium anode baskets.

Titanium forms" an oxide film that prevents it from corroding in chloride zinc baths. The bipolar nature of this film permits current flow to the zinc anodes it contacts, but not directly to the solution. Voltages in excess of 8 to 9, however, will cause an attack of this passive oxide film and the basket will deteriorate rapidly, especially in the expanded mesh area. It is therefore important to keep the voltage low and the anode baskets full.

Titanium anode baskets with perforated polypropylene panels in place of expanded titanium mesh are available (Fig. 2). These are becoming quite popular because they practically eliminate the deterioration problem, even at elevated voltage.

Brightener Oilout

Brightener oilout occurs from excess additions of chloride salts to localized areas of the plating bath, thus supersaturating the solution and kicking out organics. Spreading these additions more evenly over the entire tank surface will mitigate this occurrence.

Other problem areas

■ Elevated Chloride: High chloride concentrations may also create problems during warm weather. High plant temperatures accelerate solution evaporation, increasing the relative chloride concentration. The brightener will cloud and rise to the surface as the free chloride level increases to above 21-25 oz/gal, depending on the concentration of other solution constituents, or remain in insoluble suspension, depending on the brightener system employed. Filter clogging and dull plating usually accompany this occurrence.

If you observe this problem, simply add water to the bath; it will clear immediately as the brighteners resolubilize.

■ Excessive Temperature: The "cloud point" is the temperature at which the primary organic additive, or wetter, is forced out of the bath. Unlike salt in water, chloride zinc additives

OCTOBER 1967

are inversely soluble with heat. The higher the temperature, the lower the volubility.

The cloud point can be influenced by the pH and the chloride concentration. In addition, as the bath ages and builds up impurities and brightener products, the cloud point can decrease. Proprietary brightener systems have cloud points from 90 to 165° F. It is prudent to find out which conditions



Fig. 1 —Atmospheric evaporator for controlling solution "growth." (Courtesy Poly Products Corp., Atwood, CA)



Fig. 2—Titanium anode baskets with perforated polypropylene panels combat deterioration problem.

are routine for your bath and utilize a brightener system with a higher cloud point if you are encountering oilout due to temperature and do not want to. increase expenditures for cooling.

Chromate Adhesion

The ideal cycle following chloride zinc plating is as follows.

1. Double rinse.

2. Immerse in dilute acid or proprietary chromate pre-dip.

- 3. Chromate.
- 4. Double rinse.
- 5. Rinse in warm water.
- 6. Dry.

Many standard chromates work well. Several suppliers of brightener systems have also specifically designed chromates for chloride zinc with the intent of improving adhesion, color, etc. As with any type of zinc chromating, however, you may still be experiencing an adhesion problem from time to time, especially with iridescent yellow. This problem can be observed as parts come off the line or later, after storage. The routine causes and remedies are listed here.

• Brightener Concentration: A high concentration of organics in the plating bath will "inhibit proper chromate formation. Carbon treatment or the reduction of brightener and wetter additions will help solve the problem.

• *High Chloride:* Brightener kickout, as described above, can adhere to rack-plated parts and result in bare areas where the chromate film does not form. It is important to realize that if the bath is well filtered and clear, the insoluble brighteners may be transparent and not easily observed in solution.

. Poor Rinsing: Incomplete flushing of plating solution and brightener from the surface of a part due to inadequate or contaminated rinses will result in poor chromate formation and adhesion. A dip in 1 to 2 percent hydrochloric, sulfuric or nitric acid prior to chromating has been the traditional method of surface preparation. Also, a variety of improved proprietary chromate-free dips that offer better performance than these acids are available.

• Barrel Bleedout: This recently discovered cause of bare spots looks just like a chromate slough-off problem on barrel-plated parts, but it's not. Cracks or porosity in barrels can result from imperfect welds or equipment aging. Solution from cleaning, pickling, plating, and chromating can accumulate in the panel welds and slowly bleed out on the parts under the load stand. This will readily leach any chromate film. The phenomenon is immediately apparent on color chromated work, but only shows up in storage through white corrosion on clear chromated parts. Because the solution that bleeds out of the welds is dilute and clear, it is normally not apparent to the naked eye (Fig. 3).

To determine whether such a problem exists, leave the barrel rotating overnight in a rinse tank with 0.5 oz/gal black dye. Follow this with a rinse; trapped solution should show through the polypropylene. An alternative test is to spray methyl orange indicator on the barrel welds at the load stand and see if any red color change occurs. Bleedout solution is normally clear and acidic. Also, examine the barrels after weekend shutdowns for evidence of "salting" around the welds, indicative of the problem.

• Dryer Temperature: Excessive y high temperature in auger, conveyor or spin dryers can dehydrate the chromate film and promote failure of the conversion coating, either by itself or in conjunction with other causes previously described.

Iron Treatment

In rack plating, excessive iron buildup can cause yellowing. In barrel plating, iron codeposits as a result of the high current density that occurs the instant parts align themselves with the anodes through barrel perforations. Black spots of identical size as the perforations then appear on the work. Iron buildup, a routine operational problem, can be minimized by exercising control of its three major sources, as follows:

1. Improper pH control. The lower the pH is maintained, the more rapidly iron will accumulate in the bath. Most plating systems run at a recommended pH range of 4.5 to 5.5. Maintaining the bath above pH 5 will reduce the buildup of iron. However, be sure to maintain your process within the vendor's suggested range.

2. Metal parts that have fallen off racks, along with iron filings, burrs, and chips generated in barrel rotation. Use a tank magnet to remove these on a per-shift or daily basis, as required.

3. Drag-in from the acid pickle. If the pi-l of the rinse just before plating is below 5, you may be dragging in too much iron. Adjust the rinsewater as necessary.

Conventional treatment of iron with dilute hydrogen peroxide turns the bath red as the iron precipitates as colloidal ferrous hydroxide at pH 4.5 to 5.5. It is important to filter out this treated iron so it does not sludge on the tank bottom and coat the walls, cooling coils, and anode baskets. This occurrence is more apparent in barrel plating baths, where a great deal of iron accumulates from Sources 2 and 3 above.

Because excessive peroxide additions can increase the consumption of organics, air agitation has become an increasingly popular method of both naturally treating the iron and maintaining the iron hydroxide particles in suspension so that the filter picks them up. While air agitation has been used routinely in rack work, primarily to reduce burning, more recently it has been applied to barrel plating as well. A low-foaming bath should be employed.

As far as removing the red ferrous iron from the bath, the most efficient method revolves around the use of any media that can be precoated with diatomaceous earth. The media is not only economical to use, but absorbs the iron and screens it out. Filter bags, horizontal plates, and filter sleeves all work well as long as they can be precoated. The frequency of precoating is directly proportionate to the membrane surface area, so be sure to purchase a filter adequate in this regard.

In barrel plating, spotting can occur from untreated iron, but can also result from excessive high-current-density burning. Both can be tempered or resolved by increasing the barrel rotation speed. Conventional rotation rates are 4 to 6 rpm. Rotation at 8 to 10 rpm will reduce the tendency to burn, so long as the type of part being plated makes this option feasible.

Conclusion

Chloride zinc plating offers considerable advantages vs. cyanide-based systems, although it is not without its share of routine operating problems. The remedies offered here are all used successfully by chloride zinc platers, and will greatly enhance the reliability of your operation. □



Fig. 3-Barrel welds should be checked for solution bleedout.



About the Author

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