Guest Editorial - For Plateworld.com

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Do's and Don'ts of Acid Zinc Chloride Plating

Acid chloride zinc plating solutions have unique characteristics that make them desirable. The deposits are very bright with high luster, excellent leveling, and relatively free rinsing compared with alkaline zinc plating solutions. Other features include high cathode efficiency, 90-95 percent at usual current densities. Less waste treatment costs compared with cyanide zinc plating, and there are no chelating agents to interfere with waste treatment. The high efficiency results in less hydrogen embrittlement. It can plate castings and carbonitrided items without special pretreatments.

The less desirable characteristics of acid zinc plating include a very corrosive plating solution that can cause corrosion in areas that can entrap the solution such as spot weld areas, recessed or porous areas. The deposits are less ductile compared with alkaline zinc deposits. The solution is sensitive to iron contamination, requiring continuous means of removing iron from the plating solution. Iron forms insoluble oxide compounds that can cause roughness, yellowing of the deposit and spotty deposits. Continuous filtration is required to remove the precipitated iron. Because of the low surface tension due to the surfactants in the solution that help brightness, drag-out is less than other plating solutions resulting in a tendency to build up water from drag-in of the rinse water before the zinc plating solutions. High zinc metal in the solution allows higher CD, but less throwing power.

The three major types of plating are potassium chloride (ammonia free) Ammonium chloride, and mixed potassium and ammonium chloride.

The potassium chloride solution requires boric acid as a component to buffer the solution and prevent high-current density burning. The ammonium chloride solution has the widest operating parameters and is the most forgiving. However, it requires waste treatment to remove ammonia from the wastewater line. The third is a combination of potassium and ammonia. Maintenance costs are lower, it plates all types of metals, it does not require boric acid and the amount of ammonia in the waste stream is low, and easier to remove if necessary.

Acid zinc plating solutions are sensitive to certain contamination. As little as 2 ppm of lead, cadmium, or chromium can cause no plating in low CD areas. Copper over 10 ppm can cause dark deposit after bright dipping.

Do's and Don'ts

Do's

*Use continuous filtration. 2 or more turns/hour. Avoid excessive agitation. Spargers are desired.

*Use agitation. Air agitation is preferred because it not only provides necessary solution movement, but it will oxidize iron contamination, forming an insoluble compound that can be picked up on the continuous filer. Cathode rod can be used 3-6 ft/minute (1-2 M/minute)

*Cooling of the solution is recommended for continuous operation.

*Use pure zinc anodes, 99.9% Zn. Titanium baskets with Zinc balls. Slab or bars of pure zinc can be used.

*Use anode bags of Dynel or polypropylene. Leach anode bags in 10% by vol. HCl prior to use. New Titanium anode baskets with perforated polypropylene panels in place of expanded Titanium work well.

*keep anode bags full at all times.
* Cooling is recommended for tanks in continuous operations.

* pH tends to rise. Add small amounts of hydrochloric acid. If it is necessary to raise the pH, use potassium hydroxide or for the ammonia and mixed solutions use ammonium hydroxide.

* Add brighteners slowly over the entire surface to prevent "oil-out" of organic constituents.

* Rinse after plating well to prevent interfering with subsequent chromating or other post treatments. The solution is hard to rinse compared with other plating solutions. Double rinse.

* Precoat filters with diatomaceous earth to adsorb iron precipitated from the plating solution.

* Run barrels at 8-10 RPM to reduce the tendency to burn if possible for the part that will not be damaged at the higher than usual barrel rpm.

**Don'ts**

* Don't use paper cellulose in any form for filtration. Diatomaceous earth or Dynel can be used, also Polypropylene bags or cartridges.

* Don't exceed 9 volts when Titanium anode baskets are used. 9 V or over can cause breakdown of the protective oxide layer and dissolve the basket.

* Don't allow chromium contamination. At 50 ppm there will be lack of plating in low CD areas. Don't allow lead or cadmium contamination as little as 2 pm can cause a lack of plating in the low CD areas.

* Don't allow free chloride to exceed 22 to 25 oz/gal.(164 -186 g/L) It can cause oil-out of surfactants.

* Don't allow the temperature rise above the cloud point of the surfactants.

* Don't allow iron to build up by having the pH too low, or by leaving steel parts that drop off the racks to stay or by dragging the acid pickle from a rinse that is inadequate to remove all traces of acid.