

# FILTRATION OF ZINC BATHS

The environmental and occupational health concerns associated with cyanide zinc and cadmium plating processes have motivated many plating shops to convert to alkaline non-cyanide zinc and zinc alloy processes. The zinc deposits formed are bright (when required) with uniformity and deposition rates unheard of with the old methods. However, control of solution variables becomes more critical to produce lustrous deposits economically.

## How to control solution variables

Continuous filtration is the first step in the fight for good control of solution variables. Despite the difficulty of filtering most alkaline solutions, such as cyanide plating baths, it is the only effective method for solids removal. The slimy nature of the sludge makes it necessary to use a coarse filter media in order to reduce pressure loss and prolong cartridge life. Low and non-cyanide zinc baths require much better cleaning of parts and closer bath control. Although metallic contamination is less of a problem, floating oil can build up in the plating tank and must be skimmed off to avoid adhesion failures. Periodic carbon treatment to remove organic impurities will increase deposit brightness and reduce brightener consumption. Actually, it would be better if the problem was corrected by skimming the cleaners and carbon treating the pre-rinses.

## Advantages of continuous filtration with high turnover rates

1. Brighter deposits are obtained with a reduction in brightener cost of 20-25%
2. Throwing power is increased and faster plating rates are possible.
3. Solution agitation prevents chemical and thermal stratification.
4. Cooling coils and heat exchangers can function more efficiently with little or no carbonate scale removal required.

## Continuous filtration of acid and alkaline zinc baths is a must

There are two types of acid baths: chloride and sulfate. The latter produces a matte deposit primarily used on steel strip and wire. Bright zinc chloride baths have become increasingly popular recently as have non-ammonia, alkaline zinc baths. All of these require continuous filtration. They are susceptible to contamination, particularly with iron, which must be periodically precipitated by hydrogen peroxide treatment. The gelatinous iron hydroxide (pH 5.5) is difficult to filter since it quickly plugs most dense media.

## Proper filter cartridges and high flow rate assure results

Polypropylene or cotton filter cartridges with ratings of 50, 75 or 100 micron, and high flow rates of 2 and, preferably, 3 times the tank gallonage per hour, provided by high pressure centrifugal pumps make it possible to continuously filter any zinc solution. Although particles finer than 50 micron will pass through the filter initially, they will eventually be filtered out as the progressively denser network of fibers retains the coarser particles. Virtually all particles are removed as the cartridge becomes loaded. A high flow rate is required to keep the solids in suspension and carry them to the filter intake. The agitation will tend to keep the solids from settling on the cooling coils and at the bottom of the tank, thus helping to maintain uniform temperature. The high pressure centrifugal pump will also pack more solids into each cartridge.

The system should be sized (4 - 10" cartridges per 100 gallons) in order to minimize filter maintenance. Using 10 or 15

micron porosity polypropylene cartridges has been found suitable. Special "fibrillated" filter cartridges are easier to clean and have longer life in this application. A slurry tank with backwash piping is also desirable for acid cleaning of the filter media. A tank turnover rate of twice per hour is suggested. Non-metallic materials should be used whenever possible. Water flushed double mechanical seals are required with horizontal pumps.

## Two ways to clean old solutions

Two methods can be used to clean an old zinc solution containing solids. The zinc plating solution is pumped to a separate auxiliary tank for the purpose of settling out the sludge. The plating tank is cleaned of all sludge before the clear solution off the top of the auxiliary tank is filtered back. It is sometimes desirable to add a non-fibrous type filter aid to the solution when it is in the auxiliary tank. Care should be taken in selecting diatomaceous earth, as some will contain silicates which may dissolve in the plating solution if left in contact too long. If no auxiliary tank is available, an existing solution may be filtered by recirculation only, but frequent changes of coarse cartridges will be required until clarity is obtained.

With a new zinc solution, or one that has been filtered clean of solids, it is not uncommon to continuously filter these solutions for 8 - 12 weeks without filter cleaning or cartridge replacement if the filter has been properly sized.

## Automatic filtration systems gain in popularity

High volume applications have seen an increasing use of automatic filtration systems which employ permanent media instead of cartridges to accomplish the removal of contaminants from zinc plating solutions. These systems have been developed over the years, and in the past decade, they have achieved a justified popularity for their ability to clarify solutions with no need for labor, no media disposal problems and, therefore, no solution loss normally associated with cartridge replacement.

A typical system is computer controlled to automatically maintain solution flow and pressure through the permanent media bed. When the filter discharge drops to a preset minimum flow rate, the unit responds automatically by initiating a programmed backwash cycle to purge the bed, composed of filter media of a specific size and density, and return the system to design flow level.

## Filtration of zinc chloride flux used in hot dip galvanizing

Prior to hot dip galvanizing, the clean and pickled parts are immersed in an ammoniacal zinc chloride flux. In order to be active, the flux must contain a certain amount of ferrous iron. However, any excess is oxidized with hydrogen peroxide to ferric iron, which precipitates as the hydroxide. As the hydrous ferric sludge builds up in the tank, the solution must be clarified. Continuous cartridge filtration has been found to be much more effective than the wasteful decantation of the solution. A filter containing nine 10" polypropylene (15 micron porosity) cartridges per 1,000 gallons of flux is suggested.

## HELPFUL TIPS

With good rinsing, iron drag-in can be reduced. All fallen steel parts should be removed from the tank as quickly as possible since they dissolve in acid baths. Organic contamination is also common. If oil and grease are allowed to accumulate, they will cause adhesion failures. Therefore, any oil on the surface of the solution must be skimmed off. Periodic carbon treatment to remove organic contamination may be necessary.