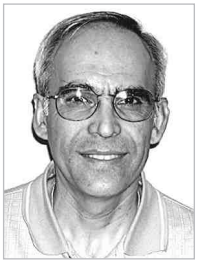
Finisher's Think Tank



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Filtration—It's a Must Have

We associate cleaning, clarifying, and purification with the process of filtration. Many of us rise each day to enjoy a first cup of fresh brewed coffee that has passed through a filter. Perhaps a filter is being used to condition the air we breathe. Start the car engine and efficiently operating oil and gas filters make the trip to work possible. These are a few examples of which there are many more that exemplify how essential filtration is to our daily lives. In fact, have you ever wondered why our bodies sustain *two* operating kidneys to filter our blood and other essential fluids? That is how important these organs are to us. In fact, the kidney is so resilient that only one can do the job of two. Take proper care of your kidneys and they should provide many decades of trouble free service.

Filtration in Metal Finishing

Let us consider some general facts regarding the importance of filtration in metal finishing. It should become clear just how important proper filtration is to influence optimum performance and quality processing of parts. Water conservation, minimizing drag out losses, closed looping, and easing the burden on waste treatment all place a critical burden on plating solutions. These are some contributing factors that make filtration so important. It is very common to filter plating solutions. This should also be done correctly and maintained on a fixed schedule. Routine maintenance of the plating bath should include analysis, hull cell, and continuous filtration. Minimizing contaminants in a plating bath greatly affects meeting or exceeding specifications, salt spray and other wear resistance tests, and realizing anticipated field service life of finished parts. Routine analysis and continuous filtration to maintain sufficient purity, inherently influence the quality of the deposit. Some general considerations with regard to filtering plating solutions are listed. Specifics, focusing on more quantitative information, can be found in many informative publications available through the association book shop on-line and *P&SF* library.

- **Carbon**. Granular and powdered carbon have been found to be equally effective. Both of these forms of carbon can be used for purposes of continuous filtration. Initially, powdered carbon purifies quicker, because of it's greater surface to volume ratio. This is why it is preferred for batch purification treatments. Granular carbon is much less dusty, generally cleaner, and much easier to work with. There are some commercially activated carbon grades available that have been chemically treated with special agents that improve adsorption activity and sequester some heavy metals.
- **Diatomaceous Earth**. These are generally forms of clay, that can be used as filtering media. They are commonly referred to as filter aids. In some instances particular organic contaminants may not be as susceptible to adsorption to carbon. Filter aids offer additional binding sites for better removal of these tougher organic contaminants. They also, in combination with carbon, help to remove fine particulates.
- **Filter Cartridges**. These are normally pleated, having different porosities. It's beneficial to the plater by the ability to remove particles down to one micron in diameter. In this way, desired clarity is achieved. Deposit roughness and pitting are avoided. The unit may be a simple, single cartridge filter. Or, it could be a multiple chambered system in which a carbon containing bag or cartridge may be inserted. Pleated or wound sleeves and discs may also be used. Very useful, especially to remove any trace floating floc that may be flowing in the discharge to sewer pipe. An excellent application for the final polishing of water in waste treatment.
- **Multiple Disks or Sheets**. A very large, effective surface area can be achieved by precoating a series of multiple disks, sheets, or sleeves with alternating layers of filter aid or diatomaceous earth and carbon. The plating solution is continually pumped through the aggregate layers to maximize particle removal and adsorption of organic contaminants. The filter can be precoated with the filter aid of choice at approximately two oz per ft^2 of disk or filter surface area. Usually, one-half to three oz of carbon per ft^2 of filter is sufficient. Filter disks can be precoated from a slurry tank in the progression of filter aid followed by carbon, with balance of filter aid. Equipment manufacturers will offer specific operating instructions for their specialized filtration units to obtain maximum operating performance.
- **Balancing Activity**. Preferred solution turnover is factored with required purification to obtain the optimum balance and effectiveness. A rule of thumb (general purposes) for nickel and other plating solutions is 1–2 solution turnovers through the carbon packed filter on a continuous basis. The requirement to replace carbon in the disk chambers or precoat filter may be determined by monitoring the rise in unit pressure versus the decrease in return flow from the filter discharge. Don't ignore these visual maintenance aids. I have pulled a few solution filter discharge to bath hoses and found a trickle, at best.

Plating deposit defects sometimes signal the urgency to perform a major purification treatment. For example, a nickel deposit may exhibit characteristics, such as brittleness, pitting, roughness, dullness, poor leveling. The result may be plating rejects, resulting in shutting the nickel bath or an entire line, because of this one solution. How the bath came to this condition is one problem that must be corrected to eliminate it from happening again.

Eliminating Contamination

Of immediate priority is the need to purify the contaminated bath, returning it to a satisfactory plating system. The preferred procedure is the batch purification. The heated plating solution is pumped to a previously cleaned treatment tank. Depending on the contamination and magnitude, treatment with powdered carbon and sometimes an oxidizing agent (hydrogen peroxide or potassium permanganate to further breakdown organic contaminants or precipitate iron) is required. The step-by-step procedures are readily available. The addition of carbon may range from 1–5 lb per 100 gallons of nickel plating solution.

When treatment has been completed, filter aid is added to speed settling of the carbon, iron hydroxide, and any other particles. The conditioned bath is then transferred back to the cleaned and prepared plating tank through a freshly packed carbon filter. Subsequent wet analysis plating tests, with appropriate additions, are made before trial plating commences.

Once satisfactory production plating resumes, careful review of maintenance or lack thereof usually furnishes corrective action, to prevent repeat or additional problems in the short or long run. In the case of a nickel bath, there are three great maintenance friends the plater can count on: (1) regular solution analysis, (2) continuous carbon filtration, and (3) dummy electrolyzing.

Is too much or aggressive carbon filtration bad? My simple answer refers to the best definition of poison—too much. For example, in the case of a nickel bath, the anti pitting agents (wetters) reduce solution surface tension, preventing the formation of stationary hydrogen gas bubbles on parts that would result in gas pits. These wetters are somewhat carbon sensitive. Overly aggressive carbon filtration will deplete the wetters to low levels, leading to the unwanted gas pits. It is recommended to follow instructions as given for types of carbon and filter aid along with surface area loading commensurate with plating solution volume.

In continuous plating operations, plating baths will always be exposed to some degree of organic contamination. This may, for example, occur by drag in of cleaners, oils and grease, thermal and electrolytic breakdown of bath additives, and the effects of closed looping. Effective filtration will minimize drag in of organic contaminants and in-tank breakdown products. Bath analysis, Hull cell, and dummying will not correct these problems. Only filtration will provide the necessary purification to remove these organic contaminants and particles. I recently spoke with Jack Berg of SERFILCO, who reminded me of just how important filtration is. It's a must have! *P&SF*