FILTERING IN THE 90's

Competitive quality coatings are creating new demands requiring new decisions in filtration methods.

The economics of the new solid waste regulations require even greater attention to maintaining the quality of plating solutions to reduce waste and rejects.

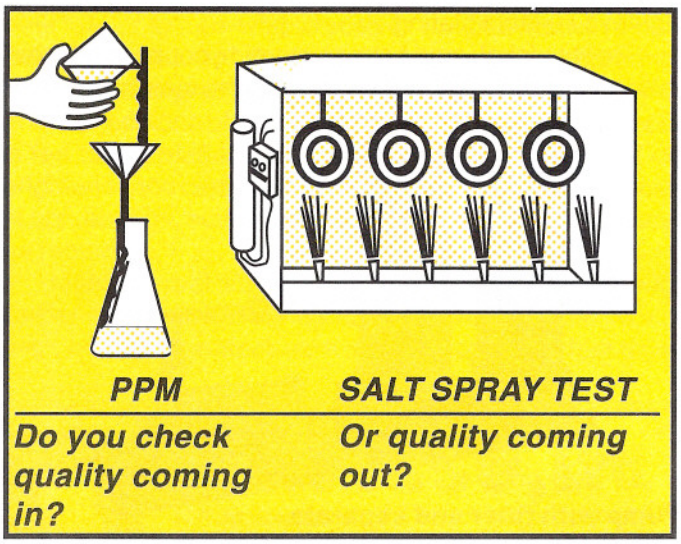
Ask anyone involved with plating chemicals what causes the most service problems and he'll tell you "contaminants". Almost 70% of plating disruption is due to roughness, peeling, pitting, etc. caused by impurities.

Therefore, attempts to control such problems have caused platers to recognize the immense importance of proper maintenance of their solutions which includes both particle removal and organic balance.

Prevention

However, in plating as in sports, the best offense is perhaps the best defense. Continued attention should be paid to preventive opportunities so that all possible measures to inhibit solution contamination are addressed:

1. *Your source of water for solution make-up.* Is it adding contamination of salts or solids such as calcium or sand?
2. *What about the air you might be using for agitation?* Where does it come from? How clean is it? Remember, it may be putting dirt particles in your bath at the very instant that plating is occurring.
3. *What about the part to be plated?* Is it totally free from processing oils, grit from grinding or polishing wheels, or even metallic particles embedded during turning, forming, grinding or stamping, which are eventually released. If so, your plating tank must be equipped with a means of removing the oils which can affect deposit adhesion and the particles before they become co-deposited. Therefore, better cleaning and filtered rinsing (including surface skimming), which can reduce solution contamination by a large percentage, should be recognized and considered.



Always keep in mind that whatever can be prevented from entering your plating tank reduces bath contamination, extends the life of high flow filters and reduces the frequency of filter servicing. And you know it is better to service a water filter on a rinse tank than a plating solution filter on the plating tank.

For example: Let's consider a typical 1000 gallon bright nickel application. Experience showed us that up to 10 pounds of solids would be collected in a filter over six to eight weeks of work. Yes, it might have been with 16 hours a day operation, a mixture of tubular and flat parts, or even screw machine barrel work. The point is that this amount of solids, if cut in half by preventive steps, makes the final job of solution clarification easier.

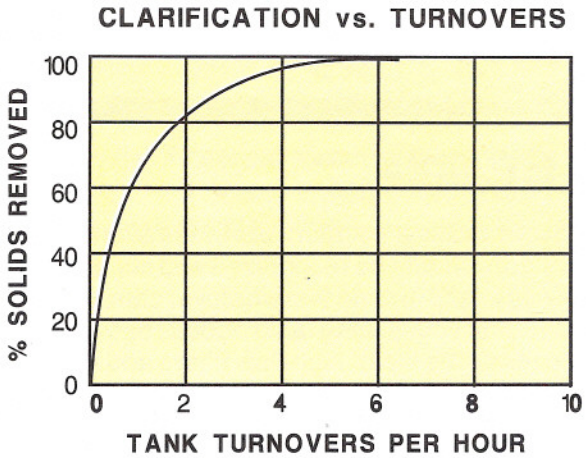
Some platers prefer to see that the solution returning from their filters is crystal clear and to check it with a Buetner funnel to assure that clarification is occurring. Even so, 90% of the solution may still be contaminated, or at least is being contaminated with soil from the air, water and objects to be plated.

We have determined that for filtration to be effective, particle removal at the highest possible flow rate must be considered. This ranges from a 90% removal at 2 turnovers per hour to 98% removal at turnover rates as high as ten passes of the total volume of solution through the filter each hour.

Flow rate or, better still, the velocity of the solution movement, is what carries the particles to the filter most effectively. It also stands to reason that the filter must have sufficient dirt holding capacity to achieve and maintain the necessary flow unless frequent servicing is provided or extra filter surface is made available.

With the largest dirt holding capacity available from coarse cartridges, servicing of the filters could be reduced if, say, 70-80% of the solids were picked up in the prefilters — leaving only 20-30% for the denser media. This could reduce cleaning frequency on the denser media filter to one-fifth as often, and reduce disposal volume. Therefore, a combination of coarse filtration plus a final trap filter for small particle removal may work best.

There is a second benefit to coarse filter media, usually available in cartridge form and referred to by its micron retention rating such as 15, 20, 30, 50 or even 75 micron. That is the ratio of solids holding capacity to filter media. For example, a 15 micron cartridge can hold 6-8 oz. of solids, yet it only requires 6½ oz. of fiber. A square foot of surface media precoated with 2-3 oz. of filter aid will pick up about 1 oz. of solids before the flow rate is starved off, rendering further operation ineffective.



Only one tank turnover per hour is not very effective at removing solids that cause plating roughness and high rejects - only 60% solids removal. Two turnovers per hour obtain around 84% solids removal, while three can achieve 92 to 94% and four can reach 97 to 98%. For the ultimate in clarity, the tank can be turned over 10 times per hour for close to 100%, and remove particles as small as 0.35 micron.

Those platers who feel that they need the denser media would do well to consider a combination of two types of filter media . . .cartridges offering coarse retention with maximum solids holding capacity and precoat media for final polishing, or a combination of coarse and fine cartridge media in series. Both types should offer solids holding capacity for 6-8 weeks of operation between servicing. This provides a margin of safety to effectively and quickly remove any sudden exposure of the plating activity to unexpected contaminants.

Therefore, the plater must decide whether or not "ultra-fine" particle removal, high flow rate/coarse filtration, or a combination of the two, is best suited to his or her needs.

Plating solutions require what we refer to as recirculatory clarification methods. These involve a balance between the percent of solids removed on a single pass through the filter and the number of passes through the filter. One pass which provides exceptional clarity still may not prevent roughness caused by the remainder of contaminants in the solution being used to plate.

A plater has the option to choose from a variety of filter types offering many different kinds of filter media.

Filter types range from those which require manual servicing for replacement or cleaning, to those which are automatic, featuring backwashing and purging or media indexing.

The author has reviewed many lab tests, whether independently observed or based on the manufacturer's best calculations. All highlight a specific feature of the product which was capable of handling a specific application better than any other. The fact that there are so many different methods and media from which to choose is verification that each is capable of effectively meeting certain filtering problems.

The plater or his consultant must be in a position to carefully assess his requirements and, after balancing the pros and cons, arrive at an approach which will be best for him. Factors to be considered are initial cost, operating cost, labor to service, frequency of service, amount of solution loss, media disposal cost, and, perhaps most important of all, what type of filter will give him the desired results continuously with a minimum of laboratory checks.

It would be difficult to choose methods or media on type of plating solution alone, because no two platers have exactly the same solution.

I would also like to point out that in general, all electroplating solutions react favorably to increased filtration. Electroless plating solutions, unlike conventional solutions, may require that the media be cleaned or changed because plate-out can occur on particles picked up by the filter. However, the more stable the solution is, the less a factor this phenomenon becomes.

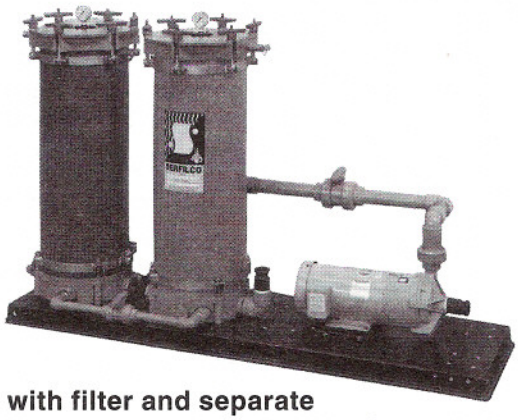
This is why bag filters were often chosen for electroless plating applications. The bags offered a single surface to collect solids which could be easily cleaned, often repeatedly. Bags were available in various porosities. Some are capable of achieving a 1 micron nominal rating, but the denser bags restricted flow whereas the medium 10 micron bags didn't always provide the desired clarity to prevent roughness.

Bag filters usually operate on an inside-out flow which tends to open the pores if excessive pressure is applied. When or if this is a problem, the plater can resort to surface type sleeves or cartridges for outside-in flow. These are available with greater surface area and are capable of withstanding higher pressure differential with ratings down to 1 micron nominal or pleated membrane capable of .1 micron absolute retention.

On the other hand, the most common conventional plating solutions can retain solids in their filtration systems for months without any harmful effects.

This is why zinc, sludgy brass or tin lead fluoborate solutions can often be clarified with coarse media, which gradually loads up with solids without blinding the surface, while maintaining the requisite high flow rates. Even nickel or zinc with large amounts of iron dissolving in the bath and being precipitated into suspension, can be clarified in this way, The use of filter aid on such solutions can be tried with surface type media. Oversizing of area is a must which, along with frequent cleaning, will probably be useful to keep contamination and PPM levels acceptable to achieve suitable plating.

Bright nickel, acid copper, cyanide copper and most precious metal solutions can usually be maintained with



Pump with filter and separate chamber for carbon purification

denser media from 5-20 micron nominal ratings. Filter aid on surface media is also commonly used.

Using the above comments as a guide, the plater must first determine the degree of quality required. Does a nut, bolt or washer require the same level of salt spray protection as an automobile or refrigerator handle? No, probably not, unless such parts were to be used on some critical space agency project. Would through-hole printed circuit boards demand the exactness of a memory disc? Probably not, unless it was a one-of-a-kind for some super computer. The answer to the question is relative.

Next, he should consider the dirt load, the solids and those greases and oils which can be removed simultaneously. The total amount of particles which get past all preventive steps is, again, relative. To some, particles which cannot be seen are non-existent. But to those where even very fine particles cannot be tolerated, filter media capable of retaining them is available and an adequate amount of surface area or dirt holding capacity must be provided.

Also, consider that gritty contaminants offer good cake build-up, whereas slimy sludges tend to blind any surface media. Here again, if a filter is being blinded off, reducing flow to zero, it is non-productive. Frequent servicing, such as once or twice a week, should be considered unacceptable. Prefiltration would be a worthwhile addition. The same is probable with solutions which tend to sludge heavily during the plating process.

The plater must also decide whether or not continuous purification by carbon adsorption can maintain his bath within the tolerable limits of acceptability, or must be switched back to batch methods which achieve total stripping of the electrolyte.

Prevention is the key to maintaining organics within an acceptable range. Two areas of contamination can be controlled. First and foremost, skimming of a cleaner or etch solution can prevent oil carryover from occurring due to surface tension adhesion to a part being cleaned. Such solution can now be filtered and carbon treated to assure cleanliness of the plated part.

Secondly, excessive brightener consumption or brightener breakdown can be prevented. One way is with a brightener feeder system which receives a signal from an amp/timer totalizer set to control a metering pump administering prescribed brightener as required. Thus, instead of over or under addition of brightener, only that amount required is fed to the plating tank, thus reducing the amount of brightener and carbon consumed. However, with the best of precautions, some continuous carbon adsorption may be required.

Many users of activated carbon believe that powdered carbon has more adsorptive capacity than granular. However, carbon manufacturers have documented test data which show that pound-for-pound, granular carbon is equal to powdered. The only real difference is that powdered adsorbs faster.

Platers recognized the simplicity of using granular carbon, but didn't always filter the solution before exposing it to the carbon. In many cases, this led to contamination, reduced efficiency and a shortened life of the carbon.

Another point to remember is that granular carbon requires a flow rate of the liquid such that adsorption can take place deep into the core of the carbon. This allows the adsorption rate to take place slowly . . .to maintain a constant level of purification. Since granular carbon is usually employed in a separate container, replacement is easy with very little solution loss, mess, or interruption of the flow from the filter. A simple bypass with valves to create a sufficient back pressure will control the flow through the carbon. Obviously, there may be exceptions, and all-out batch carbon treatment may be required. But using a separate chamber of granular carbon will minimize the frequency of batch treatment.

By using the above approach, filter media consumption can be reduced by 25, 50 or 75%. Use of coarse media with its greater solids holding capacity should be considered. (Keep in mind, all reference to coarse or fine media is relative to the application - some memory disk platers use 1 micron prefilters and .1 micron absolute final filters.) Oversizing to reduce velocity across your filter media can also minimize the blinding off effect and could extend media life by as much as 50%.

All of the above is not going to total 100% savings, but a substantial cost reduction can be the result of better planning.

Finally . . . what is left in the filter must be disposed of properly. Filter aids are often fed into waste treatment systems and compacted with a filter press. Cartridges and filter paper can also be partially neutralized, compacted and, since they support combustion, burned with fume controlled incineration.

Whatever your application requires, take the steps necessary to provide the quality so that designers, or those specifying surface treatment, will continue to look to plating for the many benefits achieved through its proper application.

by Jack H. Berg
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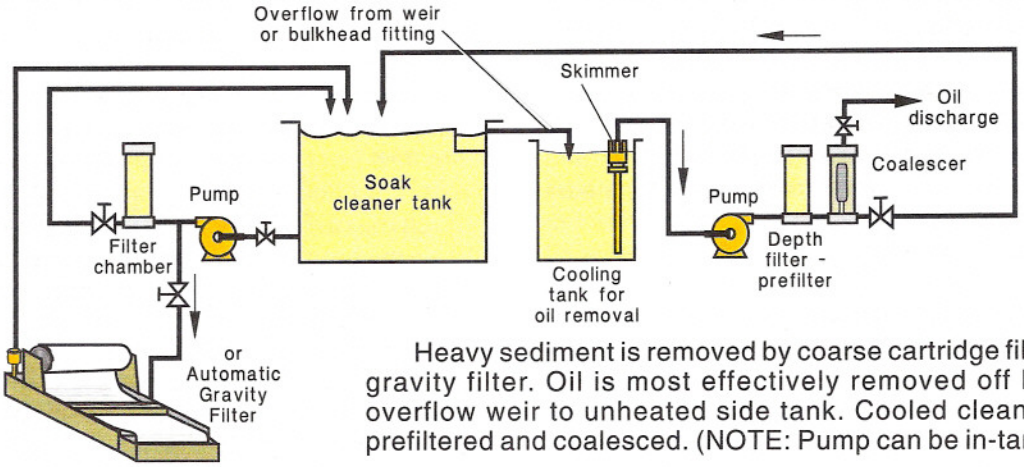
FIVE EASY STEPS TO QUALITY PLATING

Pretreatment cleanliness assures good finishes on your parts. Keep them clean and oil-free . . . easily and economically with SERFILCO engineered filtration, coalescing and carbon systems.

1 Filter your cleaners and remove oils.

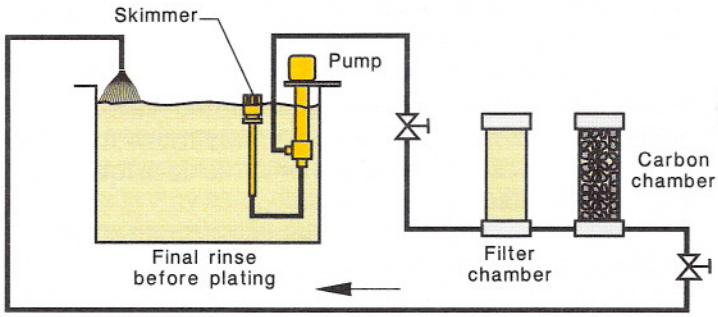


Heavy sediment is removed by coarse cartridge filter or automatic gravity filter. Oil is most effectively removed off line by feeding overflow weir to unheated side tank. Cooled cleaner is skimmed, prefiltered and coalesced. (NOTE: Pump can be in-tank or out.)

2 Filter the last rinse with carbon prior to plating.

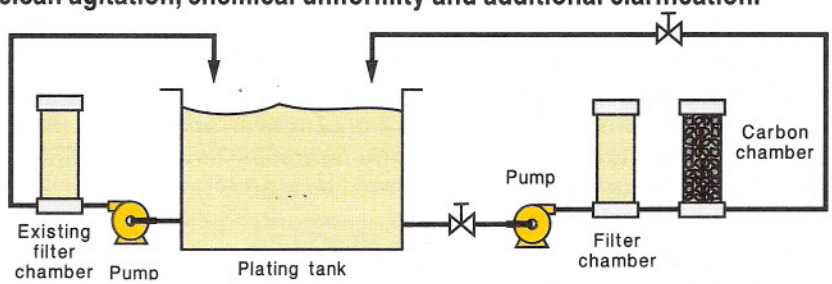
The final rinse before plating, whether after electroclean or acid dip, is your last chance to remove oil and particulate before they reach the plating tank.

(NOTE: Pump can be in-tank or out.)



3 Now balance your plating solution with clean agitation, chemical uniformity and additional clarification.

Your existing filter may be inadequate to prevent roughness. It may need weekly cleaning. A **SERFILCO** filter with optional carbon will dramatically increase dirt holding capacity. This can extend time between cartridge changes to 2 to 3 months and also keep organics under control.



4 Use SER-DUCTOR® systems for uniform agitation.

SER-DUCTOR air-free agitation uses pumps and eductors to increase solution circulation for better impingement and elimination of air sparger problems.

5 Meter solution additives into your plating tank in proportion to consumption . . . replenish as used to cut costs.