

FILTRATION OF ELECTROLESS SOLUTIONS

Electroless plating solutions are used to deposit metals such as copper and nickel by means of chemical reduction on plastic, metal or ceramic substrates. To produce smooth deposits from a plating solution, the plater must have solutions that are free of particulate matter. Crystal clear solutions are even more important when operating electroless plating solutions. Deposition from these solutions will occur on all surfaces in contact with the solution. Thus adequate filtration is vital to the success of any electroless plating operation.

Filtering Removes Insoluble Contamination

Some solutions require continuous filtration, while for others, periodic filtration is sufficient. All new solutions should be filtered after makeup and pH adjustment. All replenishing solutions added to the bath should first be filtered. Organic contamination can occur due to drag in or stop off lacquers. After lowering the temperature to a non-active condition, the solution can be carbon treated in the conventional method for nickel either by pumping it to storage for carbon and filter aid addition or passing it through the filter after it has been precoated with filter aid. Carbon filter tubes or carbon canisters may also be used with recirculation.

Proper Filter System Selection

Use of the proper filtration equipment can make the difference between good and mediocre quality and between low reject rates and costly rework. Filtration units for electroless plating should be built of materials that limit the tendency of electroless solutions to plate out on surfaces. They should be sized to provide high turnover rates and the design should facilitate quick cleanout and reuse of filter media.

Filtration systems may be installed ahead of heat exchangers used to heat the solution. However, the flow through the heat exchanger will gradually decrease as the filter becomes loaded with particles.

Filters should never be sized so as to require retaining a large volume of solids; instead they should operate with a minimum of differential pressure, to maximize the flow rates.

Fast Flow

Pumping at rates to cause 10 or more tank turnovers per hour is required to assure uniform deposits. High flow rates through the filter keep the solution free of particles and help to maintain a homogenous composition. The filter must also be chosen to provide particle retention in accordance with the surface smoothness requirement for the type of parts being plated.



EN SOLUTIONS can be filtered using out-of-tank vertical centrifugal cantilevered seal-less pumps, as in this installation.

Preventing Unwanted Deposits

In selecting materials of construction for pumps, one may partially control the tendency of electroless plating solutions to plate where no plating is desired by using materials of construction that have, by their very nature, a lower tendency to allow adherent deposition. Thus materials such as PVDF, CPVC, polypropylene and fluoropolymers are used. If deposition does take place on these plastics, the deposits may be easily removed by stripping with a nitric acid solution.

Types of Pumps

Generally, centrifugal pumps for use with electroless plating are either vertical, bearing free, for use in-tank or out-of-tank, or horizontal with double water-flushed mechanical seals. Small magnetic pumps without spindles may also be used, since they have no close tolerances that might cause binding. But pumps with conventional seals and even magnetic seal-less type pumps with ceramic shafts and bushings and thrust washers are to be avoided; electroless plating is likely to occur on the ceramic and carbon components.

Proper Pump & Seal Selection Imperative

Solutions will vary in plating from ambient to 205°F and require non-metallic solution contact or stainless steel construction. As metal can deposit on the components of the filtration system and nitric acid is often used for stripping of the system, special attention must be given to the type of pump seal and plastic used. High temperature resistant plastics such as CPVC, Ryton or PVDF are best for hot solutions.

Since the baths typically increase in specific gravity up to 1.3 with age or cycles, care should be taken in

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sizing motors for pumps. Also, platers should be aware of the limitations of the materials chosen for the pump to be used for the nitric acid strip solution.

Seeding

Particle removal by filtration is vital in dealing with the effects of "seeding" (the spontaneous creation of fine metallic particles in the solution). This may result from a temporary chemical imbalance in the solution. Further deposition will occur on the particles as long as they are suspended in the solution. Therefore, if chemical imbalance does occur and seeding results, the particles must be removed immediately by filtration. Once picked up by the filter, the particles must be removed from the filter media, too, before additional deposition occurs there; ultimately chemical depletion of the solution will result.

Since it may be necessary to remove the filter media quickly and easily, many operators select a bag-type media that can be serviced easily and reused. Open bags with quick disconnects are suitable, but aeration of the solution, causing some degradation, has encouraged the use of bags in closed filter chambers.

Sleeves also may be used in filter chambers, providing for outside-in flow. This tends to keep the pores of the filter fabric from opening. Therefore, such sleeves are preferred for finer particle retention.

Cartridges of the wound-type provide finer nominal micron selection and could, therefore, be used when the cost of the media is justified by the results desired. Pleated cartridges offering absolute retention of submicron particles are also used. But because of their higher cost, they may be installed in separate chambers for bypass filtration when the solution is not active, or they may be put on stream only when results again show the need for this type of filtration.

The density of filter media should be selected according to clarity required. Generally, 15 micron cartridges of either cotton or polypropylene fibers on a polypropylene core are suitable. Synthetic fiber cartridges, regardless of the manufacturer, should be rinsed by flushing with warm

water before placing the filter in service. One cartridge for each 50 gallons of solution and 100 GPH flow per cartridge provides two tank turnovers per hour if operated on a continuous basis. Tank turnovers up to 10 times per hour may be employed where a high degree of clarity is needed. Sizing in this manner will also provide for transfer pumping of solution in 10-30 minutes. With solutions having a strong plate-out tendency, a sleeved or pleated surface type cartridge is also effective in removing metal particles. These are easy to rinse for reuse.

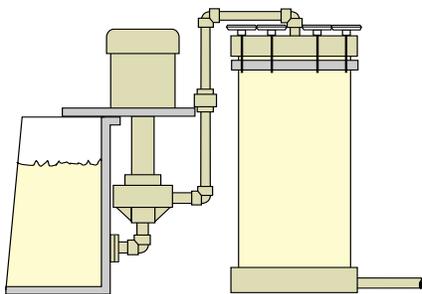
Electroless Nickel for Electronic Applications

Because of the critical tolerances in some electronics applications, high turnover rates (8-20 times/hour) as well as submicron filtration and carbon treatment are required. Since the dirt load on these systems is not unusual, high flow systems with series filtration utilizing progressively denser media in a series of chambers proves most economical. Continuous carbon treatment may be incorporated in these systems as required.

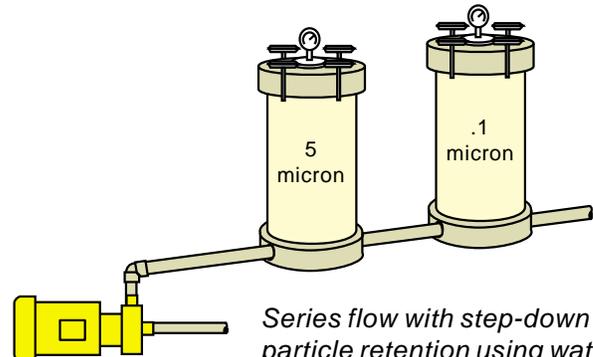
Also, since many of these baths are sensitive to organic contamination, care should be taken in the selection of materials of construction of all components in the system.

Helpful Plating Tips

The filtration of electroless nickel solutions removes nickel phosphite, which is a by-product of the plating process. Since its solubility is lower in hot solution than cold, hot filtration is more effective. If allowed to accumulate, it adversely affects bath stability and deposit appearance. Cloudiness or precipitation in a used bath is generally due to nickel phosphite. Some platers transfer and filter the hot solution to another tank at the end of each day and throw away the cartridge, even though the cartridge has usable holding capacity, in order to avoid re-introduction of the nickel phosphite. Since the cartridge is going to be thrown away, a denser filter media could be used to get the solution as clean as possible during a single pass through the filter, or on recirculation. Some prefer continuous filtration during plating to maintain maximum solution clarity and consistent plating quality.



Vertical pump, in or out-of-tank, with bag filter



Series flow with step-down particle retention using water flushed double seal pump