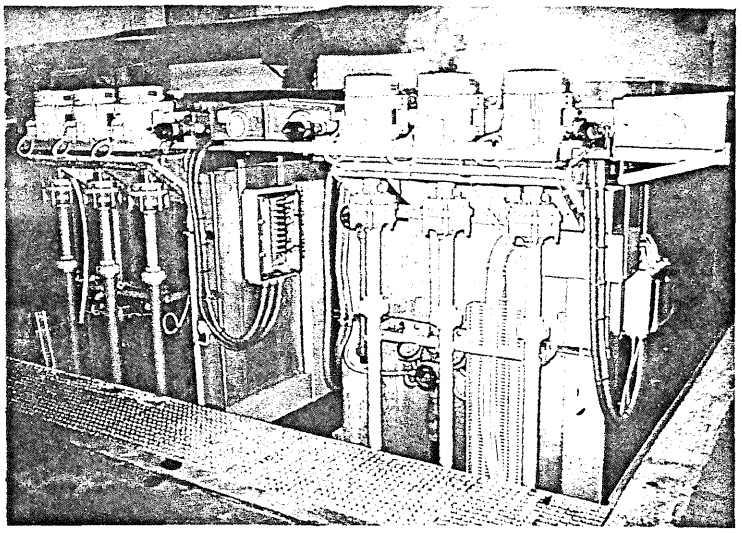
Filters for EN

Recommendations on the types of filters best for electroless nickel plating solutions..

By JACK H. BERG
President
Serfilco, Ltd.
Glenview, Illinois



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

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, since deposition from these solutions will occur on all surfaces in contact with the solution, including the surfaces of particles in the plating solution. Thus adequate filtration is vital to the success of any electroless nickel plating operation.

Preventing Unwanted Deposits. In selecting materials of construction for pumps, one may partially control the tendency of electroless nickel 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 removed easily by stripping with a nitric acid solution.

Types of Pumps. Generally, centrifugal pumps for use with electroless nickel 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 also may be used, since they have no close tolerances that might cause binding. But pumps with conventional seals and even magnetic sealless-type pumps with spindles and thrust washers are to be avoided; electroless plating is likely to occur on the ceramic and carbon components.

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 homogeneous composition. The filter also must be chosen to provide particle retention in accordance with the surface smoothness requirements for the type of parts being plated.

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-fiber type provide finer nominal micron selection, and, therefore, could be used when cost of 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.

Filters never should 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.

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

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.

PUMP SEAL AND MATERIAL IMPORTANT

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

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 at later intervals should first be filtered before adding to the plating solution. Organic contamination can occur, due to drag in, or stop off lacquers. After lowering the temperature to a non-active condition, solution can be carbon treated in the conventional method for nickel, either by pumping it to storage for carbon and filter aid addition and 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

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 provides twice per hour tank turnover if operated on a continuous basis at 100 GPH flow per cartridge. Tank turnovers up to 6 times per/hr 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 min. With solutions having a strong plate out tendency, a sleeve or pleated surface type cartridge is also effective in removing metal particles. These are easy to rinse for reuse.

SUGGESTED FILTRATION SYSTEMS

The Serfilco Labmaster or Space-Saver series filters with a sealless magnetic pump (without a shaft) using polypropylene or Teflon clad impeller magnets (because of nitric acid) are recommended for small lab or production tanks up to 600 gallons. A magnetic pump can also be used for stripping the system. CPVC or Pyrex is suitable for the filter chamber; CPVC should be considered for the larger high temperature applications up to 3000 gallons.

Serfilco Guardian and Sentry filtration systems are available for use on electroless solutions requiring non-metallic solution contact. Filter chambers on the Sentry are high temperature and acid resistant, rubber clad steel shells. These are available for tanks up to 12,000 gallons and may be used in parallel for larger tanks. Each unit features a non-metallic centrifugal pump with special water lubricated mechanical seals which prevents deposition on the seal faces.

The Serfilco intank Admiral series features CPVC construction with non-metallic solution contact. The pumps are self-priming and provide vigorous tank agitation. Very little deposition occurs from most solutions in contact with CPVC. If necessary, these pumps can be mounted out-of-tank.

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 particulates.

HELPFUL PLATING TIPS

The filtration of electroless nickel solution 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 pump and filter the hot solution to another tank at the end of each day and throw away the cartridge, even though the cartridge still has usable holding capacity, in order to avoid re-solution 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.