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TECHNICAL
BULLETIN
TF-136

FILTRATION OF CHROMIUM SOLUTIONS

Chromium deposits from an electroplating solution are used for both decorative and functional engineering applications. They vary from light to heavy in thickness using baths which plate from room temperature up to 140°F. The specific gravity, at about 1.37 is higher than most other plating baths. Pump motors, therefore, should be oversized. In some chromium baths the chemicals are in complete solution, while others contain self-regulating solids. Fluorides may, or may not, be present which would determine the materials of construction. CPVC is the most suitable plastic. Fluorides will attack most ceramic material used for pump seals, however, special fluoride resistant seals are available, as well as Hastelloy® pump shafts. A water flushed double mechanical seal is desirable.

USE PROPER FILTER CARTRIDGE

Filtration with 15 micron filter cartridges with polypropylene or modacrylic (Dynel) fibers* and polypropylene core, at flow rates providing 1 to 2 tank turnovers per hour is recommended. This can usually be accomplished with any of the filtration systems sized at 1 filter cartridge for each 50 to 100 gallons. Denser filter cartridges at higher flow rates should be employed where the highest possible clarity and deposit quality are required.

The pump used for agitation can also double as a transfer pump making it possible to pump the solution into a storage tank during inspection and cleaning of the plating tank. With increased agitation, filtration becomes necessary to remove any solids held in suspension. These will include small particles of stop-off lacquers or metallic particles loosened by the initial momentary current reversal, prior to the deposit of the chromium. These particles would otherwise cause misplating or could be incorporated into the deposit, causing roughness.

HEXAVALENT CHROMIUM FILTRATION

Filtration of hexavalent chromium solutions is becoming more and more common due to better materials of construction, especially CPVC. Increased agitation speeds up the plating rate and prevents burning at hot spots. It increases the throwing power in recessed areas and provides a more uniform grain structure with better wear qualities. The flow from the pump may be directed to certain areas of the parts to be plated, or to locations which would otherwise be dead spots in the tank.

TRIVALENT CHROMIUM

These solutions require continuous filtration. Contact with metals is to be avoided because of low tolerance for metal contamination. A filter system with 2 or 3 - 10" cartridges or precoated sleeves per 100 gallons will provide adequate dirt holding capacity. Turn-over rates of 2 - 4 times per hour are recommended. Dual cell baths that use additives require carbon treatment similar to nickel plating baths. Automatic additions using an Amp-Time feeder system is useful.

Precoating of cleanable sleeves, disc or fine cartridges may be necessary during the purification stage because of the formation of gelatinous precipitates.

LIMIT SOLIDS FLOW TO FILTER

With self-regulating baths, care should be taken to filter the solution off the top only and to bypass around the filter during agitation of the self-regulating chemicals. Any solids from the self-regulating bath which are picked up by the filter would, in time, be dissolved as required. The purpose in keeping them from the filter in large quantities is to prevent the solids from restricting the flow through the filter and reducing the amount of agitation. However, with an oversized filter the regulating chemicals can be retained on the surface of the filter media without reducing flow too much.

An in-tank CPVC pump and filter is recommended for hard chrome containing fluorides. On small tanks, a CPVC seal-less magnetic-coupled pump with polypropylene or CPVC filter chamber is also usable. The magnetic-coupled pump has no seals or bearings and, since it is in the tank, no problem of leakage.

** Verify fiber compatibility with the solution by an immersion test. Generally, the modacrylic (Dynel) is required on fluoride solutions, depending upon concentration and temperature.*

FILTRATION OF FLUOBORATE BATHS
Copper, Lead, Tin, Lead-tin, Nickel, also Tin-nickel**

The fluoborate baths are generally easy to control, but for best plating, they should be filtered continuously to remove all foreign particles. Intermittent carbon treatment to remove accumulated organic drag-in is necessary. Be sure to flush all new polypropylene cartridges with hot water to rinse off the organic lubricant from fiber surfaces. As materials of construction, plastics, such as CPVC, should be used wherever possible. Pump seals and shafts must be fluoride resistant and water flushed.

*** Refer to general bulletin covering each of these specific baths.*

FILTRATION OF ACID COPPER SOLUTIONS

Acid copper plating is commonly found in the lithographic field plating on plastics, printed circuit boards or other electronic applications. It is also widely used in the automotive industry as underplate on bumpers and trim. Recently "high throw" copper sulfate baths have been introduced for through hole plating. Due to the air agitation the bath requires continuous filtration to obtain smooth deposits. Periodic carbon treatment is also necessary to remove organic impurities which can cause deposit irregularities.

RECOMMENDED FILTER CARTRIDGE / FLOW RATE

Filtration with 15 micron all polypropylene cartridges at flow rates providing at least twice per hour tank turnover is recommended. This can usually be accomplished with a filtration system sized at the rate of one cartridge for each 50 gallons. Denser cartridges at higher flow rates up to 10 times per hour should be considered where the highest possible clarity and quality are required. Each cartridge will have the dirt holding capacity of approximately 3½ square feet. The high dirt holding capacity provided by the depth type cartridges have made it possible to operate filters unattended for 8 weeks or longer.

FILTER SYSTEM RECOMMENDATIONS

Systems consisting of pump and filter combination are recommended with a separate carbon chamber for continuous purification when necessary. Slurry tank, related piping and valves are useful if the baths have to be batch carbon treated and when being made up before the brightener is added. The slurry tank provides for easier pump priming and addition of chemicals. A carbon canister purification chamber can be adapted to any filter with bypass valve and piping to control the flow through the carbon.

Plastics such as polypropylene, PVC or CPVC are the most suitable materials for pump and filter construction. **SERFILCO** CPVC pumps using CPVC sleeved titanium or Hastelloy shafts are required at high acid concentration.

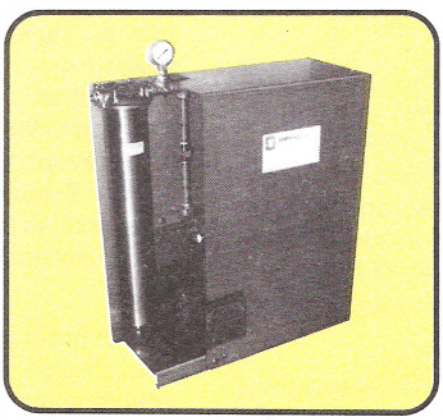
Space-Saver systems employing sealless magnetic-coupled pumps would be recommended on small tanks with acrylic or CPVC filter chambers. The Guardian systems can be used on tanks from 600 to 4800 gallons and the Sentry series on larger tanks. Any of the in-tank Admiral systems featuring CPVC chemical sump pumps could also be considered with all-plastic or lined filter chambers.

FILTRATION OF COPPER PYROPHOSPHATE

Air agitated copper pyrophosphate baths require continuous filtration with 2 - 3 turnovers per hour to remove all particles which can cause modular plating. Continuous carbon treatment to remove organic contaminants is also recommended. The carbon must be changed regularly. About one pound of carbon per 100 gallons should be used to prevent excessive build-up of organics, which causes a brittle copper condition. From time to time batch carbon treatment with the addition of filter aid may be necessary to remove all organic decomposition products. Also, occasional permanganate or peroxide treatment will extend the life of the bath.

PHOTO RESIST FILTRATION

IMPROVE PRODUCT QUALITY, PREVENT REJECTS AND EXTEND THE LIFE OF RESIST SOLUTIONS



- **ABSOLUTE OR NOMINAL PARTICLE RETENTION Replaceable or cleanable filter media**
- **STAINLESS STEEL CONSTRUCTION**
- **OPTIONAL PUMP SPEED Low RPM pumping prevents temperature increase**
- **SELF-PRIMING PUMP with built-in relief valve and leak-proof mechanical seal**
- **EXPLOSION-PROOF MOTOR**

FILTRATION OF PHOTO RESIST

Liquid photo resists are used in the manufacture of printed circuits, photoengraving, nameplates, and chemically milled parts. Photo resists are applied to the surface and processed to achieve a resist pattern that withstands etching or plating. In dip coating operations, contamination of the photo resist occurs by drag-in of foreign particles. The particulate produces pinholes and often faulty resist images. Some particulates will eventually dissolve or disintegrate in the photo resist, causing resist failure or discoloration. Since some printed circuit work has extremely fine line separation, cleanliness of the liquid is critical and requires filter media capable of removing particles in the 1 to 5 micron range and even submicron.

Photo resists are usually polymers dissolved in an organic solvent that either cross-link (negative) or degrade (positive) when exposed to ultraviolet light. Material selection for construction of components of any filtration system is important to pump life and photo resist cleanliness. Generally speaking, 300 series stainless steel is the overall best material. TFE coated metal may also be used in seals, impellers, gaskets, etc. Nylon can be used in some instances. Cotton is a suitable filter media fiber.

Users of photo resists usually work with tanks of a few gallons up to 50 or 100 gallons. Filtration is often required on a constant recirculation basis, but the batch basis is most common. Filtration on a continuous basis must be done in such a way as to prevent aeration of the liquid; or bubbles causing misses on the surface of the circuit board will result. High RPM pumps sometimes generate heat if operated for too long a period, also causing deterioration of the photo resist. A system using a low RPM self-priming pump is most desirable. *Therefore, **SERFILCO**'s photo resist filtration system includes a stainless steel filter chamber with a stainless steel gear pump driven by a low RPM explosion-proof motor.*