Chrome Plating Bath Recovery by Vacuum Evaporation

General

Chrome plating bath recovery and reuse is practical and economical, and an environmentally sound alternative to traditional methods of waste treatment and sludge generation and disposal. Because of the electrical inefficiency of chrome plating solutions, 75-90% of the chromic acid purchased for electroplating is actually lost through drag-out and subsequent waste treatment.

With a properly designed evaporative recovery system, virtually all of this chromic acid can be recovered and reused. This greatly reduces the costs of raw materials, operation, treatment, and disposal.

Chrome baths being successfully recovered are the conventional sulfate, proprietary fluoride, tri-chrome, hard chrome, and bright-dip baths. Chromic acid etch as used in plating-on-plastics processes can also be recovered. See Technical Information Sheet TI-CRE for a discussion of the latter processes.

Operating Conditions

The QVF Chrome Plating Bath Recovery Evaporator is constructed of borosilicate glass, PTFE, and refractory metal, all fully compatible with chrome-plating solutions, including those containing fluorides.

The operating temperature of a QVF chrome-bath evaporator is 180-190 °F (82-88 °C) at a vacuum of 10-12” (254-305 mm) Hg. Water distillate is recovered for reuse as rinse water with less than 10 ppm of hexavalent chromium.

Chromic acid concentrate is recovered at bath concentration and is periodically discharged from the evaporator at a temperature in the 180-l 90 °F range. It may be necessary to provide a small tank to hold the recovered bath concentrate to allow it to cool before returning it to the plating tank.

Purification

Anionic impurities such as chloride or sulfate are generally removed by conventional methods currently practiced in the industry. Drag-in of nickel solution, the principal source of anionic contaminants, should be minimized.

Cationic impurities such as nickel, zinc, copper, etc., can be reduced and their concentration controlled by the use of cation exchange resin. The resin is contained in a small column, which is separately connected to the first rinse tank -the one closest to the plating tank. The rinse water is continuously pumped through the resin column and returned to the same rinse tank. This cation exchange (“CIX”) recycle loop is separate from, and independent of, the evaporator circuit.

While all similar in principle, cation purification equipment is made by a number of manufacturers who use different resins. Therefore, the proper sizing of the cation removal unit is best left to the manufacturer of this equipment, or to your QVF representative or system supplier. As a general rule of thumb, however, you can use the following formula to size the cation purification equipment:

$$A = B x C x D x E$$

where

A = Pounds of cations to be removed per the interval E. Usually one cubic foot of resin is then required for each pound of mixed cations.

B = Concentration of cations in plating bath, as determined by analysis in pounds/gallon. (Be sure to include trivalent chromium in this value.)

c = Drag-out from plating line in gallons/hour.

D = Hours/day that plating line is operated.

E = Preferred interval between exchanger regenerations – usually 5 days.

For example, given conditions:

B = 0.05 lbs./gal.

C = 2GPH

D = 16 hours/day

E = 5 days

Using the above data, A is easily calculated as 8 pounds of cations. Therefore, 8 cubic feet of resin would be necessary for proper removal and control of contaminating ions over the chosen 5-day operating cycle.

In order to minimize the cation contamination of the bath, pay special attention to rack maintenance and the retrieval of dropped racks and parts from the bath.

Concentration Limits

Because of the relatively low evaporation rate of most chromic acid solutions, recovered bath may require some over-concentration in order to return it to the plating tank.

The QVF Vacuum Evaporator can handle a wide range of concentrations and can be finely adjusted to deliver the concentration required for a specific situation. However, please note that as the concentration of the recovered chrome bath increases, the heat-transfer coefficent of the solution decreases, and both the viscosity and boiling point increase. The result is that the evaporation rate tends to decrease as the concentration increases. For this reason, concentration beyond 60 oz./gal. will markedly decrease the output of the evaporator and generally should be avoided unless necessary.

See QVF Technical Information Sheet TI-CRE, which addresses concentration of the stronger chromic-acid etch solutions.

Other Technical Information Sheets Available

TI-CN
Cyanide Plating Bath Recovery by Vacuum Evaporation

TI-CRE
Chrome Etch Bath Recovery by Vacuum Evaporation

TI-NI
Nickel Plating Bath Recovery by Vacuum Evaporation

TI-RP
Electroplating Rinse Practice and Evaporator Sizing

TI-CR: This Technical Information Sheet supersedes all previous issues.

De Dietrich Process Systems Inc.
244 Sheffield Street
Mountainside, NJ 07092
Phone: 908-317-2585
Fax: 908-889-4960
Email: sales@ddpsinc.com
www.ddpsinc.com