



trionetics, inc.

Metals Recovery with Rota-Cat Electrowinning

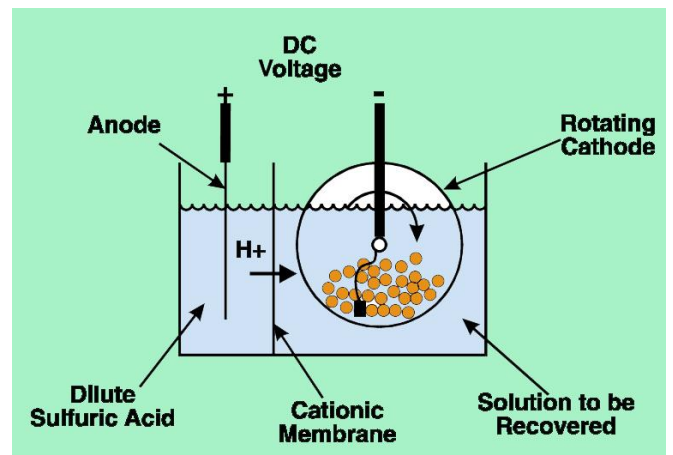


Valuable Metals Extraction & Reclaim from your waste water! In electrowinning, the goal is slightly different than electroplating. Rather than maintaining a steady supply of metallic ions to support electroplating, the goal is to reduce the concentration of metallic ions in solution by plating them out.

To meet this goal, the anodes are usually made of insoluble precious metal anodes that will not add more metallic ions to the solution as they are plated out. Although resistant, some compounds will still destroy the anodes. Free Bromine, Fluoride, Barium and Strontium compounds have all been shown to attack precious metal anodes.

Rota-Cat Electrowinning System

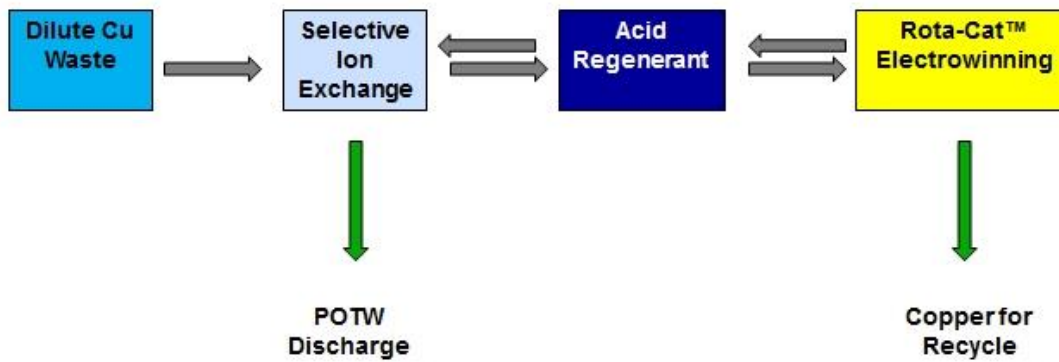
Rota-Cat™ is Trionetics' patented electrowinning system. The basic system is shown at right. A rotating cathode assembly is used with 1 cm nickel crowns or 1 cm copper balls as seed media. Current is transferred to the seed media via a *dangler* which makes electrical contact. As the cathode turns, the media is constantly rolled, plating recovered metal evenly over the surface of the media.



When media diameter increases to approximately 3 cm, it may be removed and sent for metal recovery. Purity of the seed media insures easy, cheap processing of the recovered metal. Always remove media greater than 4 cm in diameter. This eliminates your reportable hazardous waste creation and solves this issue on-site !



Although electrowinning of metal from solution down to discharge concentration is possible, it is usually not feasible due to lower plating efficiencies at lower concentrations. In practice, the system is best suited for operation at metal concentrations above 0.5 g/L (500ppm); plating efficiencies below this concentration fall off quickly. We accomplish this easily by using our **special Selective Ion Exchange Resin that is designed to attract Copper** and your other metals you wish to reclaim, thereby reducing your emissions to below your local required PPM levels.



Selective Ion Exchange Resin

– What size do You need?



60gpm



Trionetics Selective Ion Exchange 350 GPM

Membrane Isolation

When recovering metal from solutions that have significant concentrations of chlorides, the reactions at the anodes have two very undesirable side effects: the chlorides actively eat away at the precious metal anodes and chlorine gas is released.

To prevent this, a membrane is used to isolate the anode from the solution being treated. This membrane divides the electrolytic compartment into two compartments. The anode compartment contains the anode in a dilute (10%) sulfuric acid solution. The cathode compartment contains the rotary cathode and the recovery solution. The membrane used to isolate the anode is a cationic selective ion exchange membrane and will only allow only cations to migrate across it. This results in the migration of hydrogen ions (produced at the anode from the disassociation of water) across the membrane to the cathode compartment without the migration of hydroxide or other anions into the anode compartment.

The constant migration of hydrogen ions across the membrane barrier increases acidity during operation. This requires pH maintenance of the solution in the anode tank during operation. In practice, a pH monitor and a metering pump that adds caustic are used to monitor and maintain acidity at the optimum level for efficient electrowinning.

Easy Access Maintenance



Over 77 Pounds of Copper reclaimed every day at one Semiconductor Fab !

- ✓ The sale of this metal reclaim has paid for all the electricity to run the system for the year !

Potential Electrowinning Problems

Chemistry

Although precious metal anodes are used to help prevent gradual dissolving of them during the electrowinning process, some chemicals will cause the anodes to dissolve and fail prematurely. The following chemicals have all been found to degrade anodes prematurely and should be limited to the concentrations listed below:

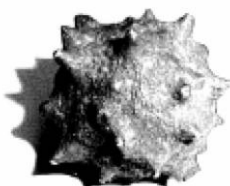
Free Fluoride <5 ppm **Free Bromine** <5 ppm **Barium** <5 ppm **Strontium** <5ppm

Nickel will not plate out unless the solution is made acidic. Typically, it will just start plating at a pH of about 2.5 and is most efficient at a pH of 3.5 to 4. As the electrowinning process proceeds, the loss of metallic ions makes the solution even more acidic. Rota-Cat nickel recovery applications include pH monitoring and caustic metering pumps to maintain correct solution pH during the electrowinning process. If the solution is allowed to become too alkaline, the nickel plated out will look burned or blackened.

Rotation Speed

Rotating the cathodes insures a consistent even plating of recovered material on the media. If the barrels (or cells) rotate too slowly, points of contact may build up and cause the effects shown below. Media removed from the barrel should be smooth and round. If not, the rotation speed of the cathodes should be increased slightly. The nominal rotation speed (set at the factory) is 2 RPM. Failure to correct this problem will cause excessive wear and premature failure of the danglers.

Too fast



ood



Trionetics can remove and reclaim many types of valuable metals from your waste streams saving you many \$\$\$ per year! Reduce your reportable hazardous waste and lower your risks of transportation and cradle to grave responsibility!

Our Lab has the capability to test your waste water and develop a proven demonstrable solution for whatever your waste challenges are, before you spend any money on equipment.

Trionetics supports many customers 100 -200 and 300mm fabs and Solar fabs around the world in Asia, Europe, Middle East, and across the USA.

Thank You !

For additional Information on Applications, References, Quote / Delivery times, and Local Support, please contact:



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