News

How to Combat Roughness in Cyanide Copper Solution

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Q: We have been experiencing roughness in our cyanide copper solution. What should we be looking at to fix this?

A: Copper cyanide solutions use oxygen-free, high-conductivity (OFHC) anodes. Oxygen levels of 0.001 percent are recommended to ensure proper anodic dissolution, which limits sludging and particulate formation. Cheaper anodes often have up to three times the oxygen concentration or more, which can lead to improper anodic dissolution.

When operating improperly, these OFHC anodes develop an oxide film with the potential to detach and aggregate into small particles or flakes, often incorporated or occluded in the copper deposit, resulting in roughness.

Let’s review some key causes of anode development and warning signs to watch for to avoid future roughness in the cyanide-copper solution.

Polarized Anodes

A significant amount of copper metal (5 lbs.) dissolves in a typical cyanide copper solution every thousand amp-hours, so monitoring anodic dissolution is vital. Anodes can become partially or entirely polarized, a phenomenon where the anodes shut down, become insulated and cease to properly conduct current or dissolve the metal anode. Insufficient current, excessive voltage or solution composition imbalances can cause this.

The anodes are forced to dissolve along grain boundaries, resulting in metallic chunks chipping off instead of dissolving ionically. Anodic material should be regularly replaced to maintain anode surface area at a 3:1 anode-to-cathode ratio. This will alleviate the potential for polarization, as will monitoring voltage levels in the tank. The basket hooks should also be checked for conductivity using tong-testers to ensure sufficient amperage.

Anode Depolarizers

Free cyanide should be properly maintained (1-2 oz./gal.) to assist in corrosion and reduce heavy anode filming. Rochelle salts, or potassium sodium tartrate, also aid in anode corrosion and thus reduce particulate formation and excessive sludging.

Anode Bags

Cotton anode bags should be used to prevent sludge and non-ionic copper particles from entering the solution. These bags should be inspected and changed out regularly.

The bag's weave should not be so tight as to inhibit solution flow but also not so coarse that small particles can escape. Sometimes, the pores of these bags become plugged, which cuts down on the flow rate and leads to polarization. Polarized anodes may increase the concentration of carbonates, which can lead to roughness and other serious quality issues.

Anode Polarization Warning Signs

Monitoring voltage increases using volt-ohm meters and amperage using tong-testers is an easy way to spot possible anode polarization. A decrease in the caustic content, an increase in the free cyanide, or a decrease in the copper cyanide concentration indicates possible anode polarization.

Silicates and other impurities can build up from the use of poor-quality chemicals. Silicates can also enter from the pretreatment side, as cleaners often contain metasilicates and, if dragged into the copper solution, will rapidly plug up the anode bags. Improving the flow rate of the rinse water and increasing the dump schedule for these rinse tanks and the acid activation tank will significantly reduce contaminants.

Rack Integrity and Substrate

Holes or tears in the PVC or plastisol coating of racks due to warping and abrasive interactions after continued use may cause the development of nodules from the plating solutions that can, due to their size and poor mechanical adhesion strength, fall off as particles.

The same can happen with the substrate due to the formation of nodules, asperities, and other defects from poor grinding and polishing, especially when processing die castings. These mechanical procedures often produce metal fines that attract electrons and build up metal deposit thickness much faster than the rest of the part. This buildup in metal lacks proper atomic adhesion and eventually falls off to form

roughness on the part.

Filtration

The pore size of the filters in the copper solution may be too high for whatever source of contamination needs to be removed. A lower pore size will help trap smaller particles, increasing the turnover rate and level of agitation and allowing more solutions to be moved to the filters. Lower pore size tends to increase the amount of material collected by the solution, forcing the pressure on the filter to increase more quickly due to the rapid accumulation of unwanted elements, resulting in more frequent filter changes.

Some diatomaceous earth materials and carbon products are insoluble in alkaline mediums, so filter aids should be tested for their solubility and solution compatibility. Siliceous filter media will build silicates in the solution, but cellulose powder is a good alternative. Calcium and magnesium salts in hard water can sometimes precipitate out to cause roughness.

Insufficient Cleaning

Failure to clean particles from the substrate, especially buffing compounds, mold, release oils, and machining lubricants, may lead to roughness as the anodes become coated with this material, resulting in polarization. These oils can also become incorporated into the deposit itself, creating roughness.

To avoid roughness in a cyanide copper solution, it is important to purchase high-quality anodes and chemicals, monitor your bath, and pay attention to ongoing maintenance requirements. This, along with improvements to rinsing practices and substrate preparation, will keep your bath running at peak efficiency and reduce the risk of anode development.

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