Finisher's Think Tank

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Nickel Plating Baths: Service Tips

As the price of nickel anodes and related plating salts continue to rise, it makes sense to service the particular plating bath properly. Problems may occur, requiring some type of corrective action. Unfortunately, poor maintenance or lack of standard control become very expensive mistakes that could have been avoided. These factors result in nickel plating rejects, production drop or shut down, failing to meet delivery dates and other unfortunate situations. All of these highlight the need to pay now in proper maintenance, thus saving significantly in the end result. Process suppliers of proprietary brighteners have typically built a comprehensive working knowledge of the systems they sell and service. Their field service technicians and lab support staff can offer quick, effective response to most service needs and assist in the implementation of corrective action. At times, it helps to be pro-active, initiating in-house service, as time is valuable and could be quite expensive. Some items for consideration are listed as helpful tips.

Anodes

S-type, sulfur-containing anodes are used most prevalently in bright nickel plating. R-type is also used. The S-type is more conductive, requiring less voltage for plating. A black film of insoluble sulfur forms on the S anode skin during plating. At times, especially with the cost of nickel, R-type might be purchased at a price cheaper than the S-type. Sometimes this results in a mild panic, when the plating voltage has to be raised to meet the desired current densities. Be advised beforehand as to what occurs when a switch is made from S to R anodes. Whichever anode type is purchased, first request a certified analysis for the material. Only the highest purity should be used, typically over 99.5% as nickel. Caveat emptor! Let the buyer beware.

When filling the anode baskets, take care not to add even one other plating bath anode inadvertently. I have seen this happen a few times. Just one zinc ball in a 1,000 gallon nickel bath results in catastrophic problems. There is a maintenance problem that can occur if not checked for. Through plating use, the anodes tend to settle, sometimes forming empty pockets. This can result in polarization and lack of localized plating on parts facing the blank zones. When not in use, a bar or rod should be lowered and raised in the basket, filling the voids, eliminating this problem.

Anode bags

It is good practice to change anode bags when there are large additions of anodes to be made into the baskets. Remove the baskets, empty the remaining anodes and wash them and the baskets. The bags should be pre-washed in a solution of 5% sulfuric acid containing about 0.1% of the nickel wetting agent. This removes any organic sizing related materials from the fabric, eliminating an organic contamination in the nickel bath. Dynel bags are recommended. Double bagging can also be used. The inner bag is Canton flannel, and the outer bag is Dynel. Maintenance replacement of bags is important. Aged anode bags will tend to plug, resulting in polarization and deposit pitting. During production use, the bags may also tear or rip. Including anode bags in the standard maintenance list should greatly minimize any of the related problems.

Metallic contamination

The most common metallic contaminants that can be dummy-electrolyzed out of solution are copper and zinc. Gray to black, streaked deposits in the low current density areas indicates this type of metallic contamination. For minimal-to-slight deposit streaks, proprietary purifiers added to the bath effectively whiten the deposit. This permits continued, uninterrupted production use, until the bath can be shut down for proper dummy-electrolyzing. The purifier is not a cure, just a temporary fix until proper dummying can be conducted. For severe contamination, typically above 25 ppm of copper or zinc, immediate dummying is required.

For optimum dummying, it is best to lower the bath pH below 3.5. Use scrap parts, corrugated sheet metal or expanded metal (focus on a significant low current density area for the dummy). First, plate a thin uniform deposit of nickel over the entire dummy. Then, lower the current density to plate out the metallic contaminant aggressively. Thorough agitation, either air or mechanical, is very beneficial. For zinc the current density would be 4 A/ft^2 for less than 50 ppm of zinc and 2 A/ft^2 for levels above 50 ppm of zinc. For all levels of copper contamination, dummy at 2 A/ft^2. Every 60 to 90 minutes, raise the current density for 15 minutes to the range used for nickel plating. Stop dummying, raise the dummy and observe the deposit appearance in the low current densities. If it is black or gray, continue the dummying procedure. Once the low current densities confirm preferential deposition of white nickel, the dummy purification can be stopped. The bath will then have been sufficiently purified.

The problem leading to the need to dummy must be addressed. The main cause is due to parts dropping off racks, or more commonly out of plating barrels. Be certain that racks and barrels are in good service and the correct ones are used. Prior deposition of copper should sufficiently seal the base metal surface. The following example should illustrate how important this is.

Consider a situation where one pound of zinc parts drops into a 500-gal nickel bath. 50% of the parts dissolve, resulting in 120 ppm of zinc contamination. It can happen that quickly. Therefore, regularly checking for and removing dropped parts is very important. If suited to the particular operation, fasten a net across the tank bottom to more easily retrieve the parts.

There is another maintenance procedure, if space permits, that could be set up. This would be a continuous dummy cell, operating whenever the plating bath is running. The plating solution pumps to the purification tank, where the solution is dummied, then pumped through a carbon filter, and returned to the plating tank. For a 500-gal nickel bath, at least a 50-gal purification cell, dummying at 2 A/ft^2 should be sufficient.

Organic contamination

Deposit brittleness, clouds, hazes, pitting and overall dullness are usual indications of organic contamination. Brightener breakdown products, drag-in of trace cleaner rinses, residual oils and grease on parts will gradually build up with time in the plating bath. This contaminant buildup problem has become more prevalent with the extensive application of closed looping. It can be greatly minimized by continuous carbon filtration. Approximately two to four oz. of carbon in the filter per 100 gal of plating solution volume should be sufficient to remove light to moderate amounts of organic contamination. Diatomaceous earth is a suggested filter media. Manufacturers of specific filtration equipment typically recommend how to charge their units with carbon, equipment maintenance and re-charging. The important item is not to let a fresh charge of carbon go on without any changing. I have seen return flows from the filter greatly diminished due to the extensive clogging of the filter medium. Without routine maintenance and changing of the carbon pack, there is little to no benefit derived from carbon filtration. In the event of severe organic contamination, a batch treatment with a heavier dosage of carbon would be required, along with the possible addition of an oxidizing agent, such as hydrogen peroxide or potassium permanganate. The appropriate amounts of purifying additives should be first determined in the lab, based on the particular problem and effect of bench scale treatment.

A nickel bath, especially in these expensive economic times, is not worth gambling on. It is better to take the conservative approach and maintain it properly, adhering to a good service schedule. *P&SF*