

## Finishers' Think Tank

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Have a problem on the finishing line? To send your question, use the convenient, postpaid form on our Readers' Service Card, or send a letter to: Finishers' Think Tank, 12644 Research Pkwy., Orlando, FL 32826-3298

Stains on Large, Cast Iron Parts We process heavy cast iron parts, weighing as much as 700 Ib. On these, we deposit electroless nickel, in thicknesses up to one thousandth. After we remove the parts from the rinse solutions, it takes only a matter of minutes for the parts to turn brown and stain in the non-machined areas. How can we prevent this from happening?

**A** Cast iron parts-especially large ones—are very porous and fairly difficult to coat properly. The porosity problem is compounded by the fact that the surface may contain silicates from the casting operation. And, it is difficult to descale because of the high concentration of carbon usually present in the casting alloy.

Preparation of cast iron parts: This is a difficult matter because of the surface imperfections and the alloy make-up. Cast iron will act as a sponge and soak all the pre-plate solution into its surface, causing further processing problems. It is very easy to either over-or under-prepare the parts. Too little preparation will result in the surface's containing dirt, oil, grease and silicates; too much will raise a smut on the surface of the parts and cause an inefficient, non-adherent coating to form. The best method for preparing the surface is the inclusion of high chelated cleaners to do most of the cleaning and scale removal. Acids will tend to overreact because of the surface characteristics, and lower concentrations of acids should be used after scale-loosening in alkaline systems. Sulfuric acid-based materials, with a reasonably high fluoride concentration, are the best for descaling. because of the affinity for removing both iron oxides and silicates. Because of the porosity of the surface of the cast iron, it is important that a dynamic rinsing system be used. Flowing rinses, alone, will not remove the process solutions from the pores. High-pressure sprays or ultrasonic rinses are in order, to provide the best, most-reliable rinsing.

Cast iron parts are usually structural in nature, and their mass and strength are the rationale for use. There are three main reasons for plating them: Corrosion resistance, functionality (hardness), or cosmetics. It is important that you identify the purpose of the coating before deciding "on the preparation cycle and thickness of the deposit. The color change to the surfaces represent a premature failure of the coating, in terms of corrosion resistance. The immediate color change is tantamount to a flash rust. There is probably exposed iron, which, because of the high porosity, will cause oxidation of the surface at a high rate.

The proper thickness of the coating will have to be determined on the basis of filling of the pores. The coating should be tested at various thicknesses and corrosion responses made. Electroless nickel protects by virtue of creating a continuous coating over the surface. It becomes ineffective, in terms of protection, if the surface is flawed and not completely covered. A graph should be made with plating thickness on the X axis and corrosion response on the Y. The response of the parts to this kind of test will be quite evident as to the proper thickness of deposit. A break in the graph will inevitably occur at the point in which all the pores are covered. Plating to thicknesses below that point will be useless, and the part will fail in service.

If corrosion of the surface is not a factor in the job you're plating, you may want to prevent that brown flash-rusting from occurring by passivating the exposed iron with a chromium passivate or by covering the surface with an organic coating such as a light oil, polymer, or a fatty, acidbased soap. These will all lead to better cosmetics, but unfortunately they will not drastically increase the corrosion-resistant response from the coating.

A sample cycle follows, with detailed

descriptions of the process chemistry. Keep in mind that proper rinsing should be conducted between each step.

- •Soak clean with a highly chelated, lowalkalinity detergent-based cleaner. This cleaner should have the ability to remove oils and greases and be able to dissolve iron oxides and scale.
- •Electroclean with a low- or non-foaming, highly chelated cleaner, to loosen and remove scale from the parts. It should be free-rinsing, to allow the solution removal from the surface.
- Rinsing at this point should be dynamic, with high-pressure or ultra-sonic rinses, to completely remove process rinse water from the surface.
- •The acid pickle should contain both sulfuric acid and high concentrations of fluoride, to remove all final scale and silicates from the surface.
- •The last step before electroless nickel is a station that contains one of the primary salt complexors contained within the electroless nickel formulation. The complexor should be able to remove loose iron oxides and to operate at a pH close to that of the electroless nickel bath.

This is intended as a "primer" on cast iron plating, and 1 hope it helps point you in the right direction. For the actual, best cycle, it will take much trial and tribulation.

## Counteracting Zinc Contamination From Diecast Parts

We process a mix of zinc diecast parts, as well as steel, in copper-nickel-chromium. Our nickel tanks inadvertently get contaminated with zinc. As a result, the corrosion response and the quality of our parts vary with the condition of the plating solution. What changes can we make to get consistent results?

**A**. Addressing problems when they become evident in poor-quality results. I believe that it is just as important to judge the parameters of a metal finishing press

that is operating well. In a system like yours, the contamination level will vary, because of the mix of parts, their configuration, and operators' promptness in removing fallen parts from the tanks.

Perfection is rarely achieved in any multi-sequenced process facility, but a steady state can be sought. Attention to the contaminant levels and the quality of the process parts should be examined, and a threshold level of contamination should be addressed. You describe the use of electrolysis to remove contamination, or to treat your tanks when contamination gets high enough for noticeable failures. It is my contention that a better way to achieve consistent results is with continuous treatment of the process solution. A continuous, off-line electrolysis system should be used and should be large enough to handle the worst-case contamination, but it should be run constantly to keep process solutions at peak performance at all times.

Batch treatments tend to be counterproductive, shutting down systems from production for periods of time, and they also are inclined to develop a significant slug of waste materials that needs to be disposed of properly. Controlling a process system is most effectively done in a consistent, coordinated way. Preventive maintenance procedures, such as raking the tanks, should be enforced and carried out with great care.'

Focus on this kind of situation is very important and can be used to foster greater quality in all aspects of the process system. Purification techniques must be integrated and modified on an ongoing basis, to allow for the consistent operation of a plating line. When looking at the cost of operation, you can minimize the impact of quality on the line with the increase in the consistency and percentage of time the system is "up and running," and not in treatment.

Electrowinning Copper from Waste Cyanide Copper Concentrates We are electrowinning copper from waste cyanide copper concentrates and we have difficulty in determining the concentration of copper in solution. The analyses differ from lab to lab. What can the problem be and how do we get around it?

Copper plating solutions become waste for only a couple of reasons—the discontinuing of that process; or contamination of the process, which necessitates disposal. Very often, the spent solutions are so because of contamination with other metals. Cyanide is a material that dissolves many metals and brings the ions into solution. It is used, at times, as a final cleaner and deoxidizer, to do some final descaling before further processing.

This is especially true with iron components. Iron oxides are very soluble in cyanide copper systems. Iron will also cause an interference in the analysis of the copper. Other interfering materials are zinc and nickel. These materials will interfere with both wet and atomic absorption analysis.

To address this situation, it becomes necessary to configure your analytical approach to isolate copper in the presence of other similar metals in the solution. The method-of-choice for atomic absorption analysis of your cyanide copper is a graphite furnace. This will remove most of the interferences from the analysis and will also isolate copper, providing the most reliable results. In a wet analysis, it is necessary to tie up the interfering materials so that they do not enter the test. The use of ammonium bifluoride to react with the contained iron is common.

To determine the best analytical approach to the individual solutions being processed, I recommend that you first run an emission scan on the sample, to determine what metals are contained. With that information, you can determine the best analytical technique to use.