## Finishers' Think Tank



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Have a problem on the finishing line? Please send your question to "Finishers' Think Tank," 12644 Research Pkwy., Orlando, FL 32826-3298; or e-mail to journal@aesf.org.

Chromium in the Discharge We are having a problem with chromium getting into our discharge from the plant. We treat the chromium and seem to have good control of our waste treatment system, but some chromium always seems to find its way into the discharge. Any suggestions?

A Chromium is insidious—it gets everywhere—on my new suit and tie, on my hands and gloves and everywhere you can imagine. Personnel working around a plating line will get materials on aprons, gloves, etc., and then wash it off at a sanitary discharge (such as a restroom sink). If the load is enough, it will definitely show up in the wastewater. It might help to install a wash-up station with the discharge going to the waste treatment system.

Another area of concern involves the steam lines or chiller lines on the chromium solution. Sometimes, holes in the heat exchange surface will cause chromium to find its way into the system, where it becomes part of the boiler blow-down and can damage the equipment. For this reason, it is best not to return the chrome condensate.

The last area to check is the scrubber wash-down. Many times, it is not properly plumbed, which can allow for wash-down water to escape into the drain untreated.

Blistering on Aluminum Castings We are having problems plating over aluminum castings. If we plate it with bright

## nickel and chromium and then heat to 44 °C, the parts blister. They look fine beforehand—can you help?

A luminum castings require careful handling, because they can be adversely affected by preparation cycles. All castings are porous, with varying degrees of porosity, which will cause solutions and materials to react with the surface, resulting in adhesion problems. I try to keep the parts out of alkaline systems altogether, and degrease the parts prior to using a neutral soak cleaner to wet the surface. Finally, I etch with an acid etch. This procedure seems to solve any latent adhesion problems.

As an example, we had a job where we tested for adhesion using a grind saw test. The parts passed successfully the first day or two, but a week later all of the parts demonstrated poor adhesion. I concluded that solution had been trapped in the surface of the parts, which reacted and caused a layer of non-adherent aluminum on the aluminum. When peeled back, there was aluminum on both sides of the failure. Keeping the parts out of alkaline solutions allowed for successful processing.

Using electroless nickel over zincate tends to remove the zincate from the surface and allow for deposition directly over the aluminum surface. This will allow for better adhesion of the subsequent coatings. A mid-phosphorus electroless nickel (< 7% phosphorus) will allow for plating without passivation. A highphosphorus EN will tend to passivate, resulting in adhesion problems.

Experiments have shown that to eliminate porosity effects, electroless nickel seems to be the best. When performing corrosion testing of a component that has a final finish of nickel and chromium, we have found that by keeping all parameters constant and varying the EN thickness, a difference can be seen in corrosion resistance until a thickness of 0.7 mil of EN. The study concluded that at 0.7 mil, the porosity of the casting was covered, and corrosion response was normalized to the subsequent coatings. The recommended process cycle is as follows:

- Degrease
- Rinse
- Wet surface in a neutral soak cleaner
- Rinse
- Acid etch in 8 oz./gal ammonium bifluoride at 110 °F
- Rinse
- Deoxidize the surface in a solution of 40% nitric acid, 40% sulfuric acid with 4 oz/gal ammonium bifluoride to remove most alloying agents from the surface of the casting
- Rinse
- Zincate (I prefer an alloy zincate)
- Rinse
- Electroless nickel plate (mid-phos)
- Rinse

After the EN coating is applied, there should be no problem plating bright nickel and chromium on the surface of the castings.

## Blackening Cadmium

## Q. Can you describe a process for blackening cadmium plate at room temperature that will give a consistent finish?

A. The formation of a chromate conversion coating on cadmium involves several reactions to occur simultaneously. In forming a chromate conversion coating, the cadmium-plated part is immersed in a solution containing hexavalent chromium and other materials. The metal oxidized by the hexavalent chromium reduces the chromium to its trivalent state. The pH of the surface reaction then rises, and a chromium hydroxide and oxides of the substrate metal occur on the surface. This forms an amorphous gel that, when dried out and properly cured, will help to protect the cadmium deposit. In the case of a black chromate, a reduced form of silver is included in the deposit to yield a darker, more uniform color.

To obtain a high quality level of a chromate conversion coating, it is imperative that the cadmium deposit be smooth and fine-grained, free from porosity and at a low level of organic inclusion. Low brightener levels are required to give a good black chromate coating. By limiting the amount of organics included in the cadmium deposit, the chromate solution will uniformly attack the cadmium deposit. As the concentration of organics in the deposit increases, the uniformity and utility of the chromate conversion coating diminishes.

Another consideration is that the plating solution must also be clean and free of contaminants. That includes organic breakdown products, heavy metals (such as copper and lead) and carbonates, which will increase the porosity and cause the need for higher-than-normal levels of brightener. Carbon filtration of solutions that are not used primarily for black conversion coating will keep them operating at peak performance.

In addition to controlling the plating bath parameters, the following should be controlled:

- pH—pH will affect the amount of chromium included in the coating, and will greatly affect the color and corrosion resistance. At high pH levels, the coatings tend to be thicker, more colored and more resistant. The pH range of most chromate conversion coating solutions is from 0–2.8.
- Hexavalent chromium concentration—This will influence the amount of stripping, oxidizing of the deposit and amount of chromium available to be included in the coating. The amount of chromium trapped in the film will determine the ultimate color of the deposit.

- Temperature of the solution—Too high a temperature (>90 °F) will result in high iridescence, a cloudy appearance, loose deposits and accelerated stripping of the base metal. A too-low temperature (<70 °F) results in thin coatings, milky appearance and dull coatings.
- Time in the solution—Too much time results in too much stripping and an unstable coating, giving varying results (mostly poor) of corrosion resistance. It will also cause an excessive consumption of chemicals in the process, which will curtail the life of the chromate solution.



Most platers eventually attend AESF Week or make a visit to AESF Headquarters in Orlando, FL. Here's a sampling of local eateries.

*Breakfast:* You can find lots of breakfast spots around town—many with a diner-type quality and '50s decor. **Brian's**, at 1409 N. Orange Ave. (north of downtown Orlando), offers home-style, low-priced breakfasts—and great grouper sandwiches for lunch, too.

**Clarkie's**, at 3110 S. Orange Ave. (south of downtown), provides the best breakfasts and rhubarb pie around, with huge servings and quick service at reasonable prices.

*Lunch:* Admirers agree that **Antonio's Restaurant & Pizza**, 3916 S. Semoran Blvd. on the way to the airport, has some of the best pizza in town. Special kudos for the "great white" version and terrific calzones.

For great bar-b-q, try a quick bite at **B's Bar-B-Q** on Primrose Ave. (best baked beans in the universe), or **Barney's Bar-B-Q** on S. Orange.

**Sorrento's**, 651 N. Primrose, is a family-owned, down-home Italian restaurant that has been in the same location for 15 years. It serves superb house specials and great pizzas at moderate prices.

If you're looking for something a little more upscale, try the **Briar Patch** on Park Avenue in posh • Silver concentration—The use of a black chromate requires additional chemistries, such as the addition of silver nitrate in the system. Adhering to the preceding parameters will help achieve a good quality deposit. Silver concentration and consumption also seem to vary at different times of the year. In the early spring, I have found a significant increase of silver consumption in shops not using anionic deionizers to feed the rinse system. This can be traced to an increase in chlorine used to clear the water treatment lines after winter. PESF

Platers Gotta Eat! A Restaurant Review By Marty Borruso

> Winter Park. This American sidewalk café is the place to see and be seen. Stacked-high sandwiches, big salad portions and reasonable prices are on the menu.

*Dinner:* French in the south—who knew? Close to Disney and AESF Week is **Le Coq Au Vin**, 4800 S. Orange Ave. Chef-owner Louis Perrotte has made this bistro a local favorite with his creative, seasonally changing, country-French menu. The professional and friendly staff, charming ambiance and good value make this a "must-stop."

Another French restaurant is affectionately called "The Mason Jar" by the locals. **Maison et Jardin**, 430 S. Wymore Rd., Altamonte Springs, offers fancy and formal continental cuisine that is tops in all categories. A class act with impeccable service, it earns extra praise for its romantic atmosphere and outstanding wine cellar.

Finally, **Peter Scott's** (not French, but great) in Longwood Village off State Rd. 434, provides a bit of Manhattan's east side, with a supper club that offers gourmet international fare. There is an extensive wine list and Michael Feinstein-ish entertainment in a beautiful upscale dining room. Few places in Central Florida offer such fine dining and dancing. @