Think Tank

Stephen F. Rudy, CEF
Enequist Chemical Co.
100 Varick Avenue
Brooklyn, NY 11237
718/497-1200
E-mail: sfrudy@aol.com

Cool It ... Chill Out

Finishers and platers take note: It's time to prepare for warm weather, heat, and the coming dog days of summer. Let's review some items comprising an action checklist for required cooling and chilling.

✓ Acid Copper—The bath needs good temperature control, if the requirement is a full, bright, leveled deposit. A temperature range of 70–90°F is typical. Deposit dullness, especially in low-current density, becomes more prevalent as the solution temperature rises. Cooler temperatures will reduce cathode efficiency and the effective plating range. These conditions make acid copper solutions particularly sensitive to seasonal conditions. Copper sulfate, depending on bath concentration, precipitates out if the solution temperature is cold. Warmer baths may contribute to increased copper metal concentration. Continuously operating production baths require chilling for optimum performance during seasonally warm weather.

✓ Aluminum Finishing—

1. Anodizing solutions maintain a critical dependence of solution temperature control. For example, the sulfuric acid anodizing range is 6–75°F; hard coat anodizing is 25–35°F; decorative anodizing is 60–80°F. Whether an external heat exchanger or cooling coil, the equipment should be maintained at peak performance.

2. Zincating solutions (single metal and alloy types) are sensitive to operating temperature. Remember to disconnect or pull out heaters now being used to keep temperatures above 65°F. Higher than recommended temperatures will accelerate formation of the zincate film, resulting in a thick, porous, poorly bonded deposit. It may be necessary to control temperature by chilling (coil or cold water hose). Avoid excess heat transfer from nearby tanks (soak cleaners and etchants), by insulating them with code-approved material.

✓ Brass—Specifically, conventional, low-temperature baths operate from 70–110°F. Brightener (proprietary organic or ammonia) consumption increases with temperature. Accordingly, so does the build-up of problematic carbonates. The plating process itself generates heat, and continuously operating production baths may require chilling or cooling. Now is the best time to chill a bath to precipitate and remove excess carbonates.

✓ Cadmium—Because of military and industrial specifications, there are plenty of operating cadmium baths. The acid and cyanide baths are maintained at a range of 70–90°F; neutral chloride and acid fluoborate at 70–100°F. Each system requires a suggested temperature balance to provide the optimum plated deposit.

✓ Chromates—Expanded technology and solutions now offer baths that operate from cool-warm to boiling. Most standard chromate finishes (clear or blue, yellow, iridescent, black, green) are temperature-dependent. An acceptable range for these baths is 65–95°F. Temperature increases accelerate etching of base metal or plated deposit, and formation of the chromate film. This can detrimentally affect the properties and adhesion of the chromate. Each process requires a set of control parameters, with temperature being critical. Confirm this for your chromating solutions and implement appropriate temperature control.

✓ Electropolishing—Because this process depends on alternate heating and cooling during use, both sources must be available. Stainless steel plate coils (usually series 316) are used for cooling, or an external heat exchanger may be used. Appropriate chilling is usually related to drawing more than 10 amps/gal of electropolishing solution. Dissolved metals build up in the aged solution, increasing viscosity. Sufficient solution agitation is required to maintain uniform temperature distribution.

✓ Stannous Sulfate Tin—The bath maintains a tight operating temperature range, 70–90°F. Low temperatures due to winter's chill may result in gassing and darker deposits. Higher temperature increases brightener and wetter consumption. This can affect the deposit's post-handling (*e.g.,* soldering) and tarnish resistance. Tin metal growth in the bath also contributes to cloudy deposits. Plating requirements and amp hours will warm the solution. Temperature control is very important for this process.

✓ Zinc—Cyanide, non-cyanide, and chloride baths are affected by bath temperature. The first two may operate from 65–125°F. The acid bath from 65–135°F. All three share the follwing negatives at higher operating temperatures: increased brightener (organic additives) consumption, chromating problems associated with deposit structure, and increased zinc metal dissolution. These baths are prime examples of the importance of solution chilling. Seasonal conditions don't necessarily come into focus. Rather, it's the production load and magnitude of plating. Appropriate control of solution temperature improves process bath operation, which in turn contributes to a standard, preferred plated deposit. Conductivity increases as the temperature rises, resulting in improved efficiency. For each plating cycle or operation, positive temperature setting must be optimized versus the potential negative effects.

✓ Zinc Alloys—All these baths (acid and alkaline nickel, cobalt, iron, tin) are sensitive to temperature, with respect to deposition of the preferred zinc-alloy ratio. This is critical to the performance of the baths and corrosion protection of the finished deposit. Temperature control, especially chilling baths that tend to get warmer, is vital.

What we've discussed here are some of the more temperature-sensitive finishing processes. Cooling (or heat exchange) can be as simple as running a cold-water hose through the solution or partially immerse a crock or small tank of the solution in a jacket of cold water. On a larger scale, plate coils or external heat exchangers are used. Text articles are a good reference for equipment description. Equipment manufacturers and suppliers of the process solutions have the expert background to recommend, install, and help maintain the cooling operation. Check into your requirements now. Keep cool in summer's heat as your process solutions chill out. ***P&SF***