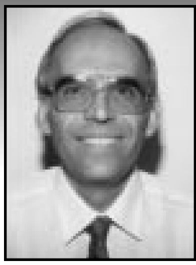

Finishers' Think Tank

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Glitches in Every Direction; Problems in Any Possible Way

Last month's column must have conjured up some interesting "tales in the trenches." Fact is, everyone remembers particular problems or situations that produced startling—even baffling—results. As we reminisce, many unique situations are flavored with a dash of amazement, a pinch of the unknown and a sprinkling of luck, then sautéed with doubt and topped with a victory cherry. The best part is seeing any problem through, understanding the cause and correction/prevention, and doing one's best to prevent a curtain call by remembering the lesson learned.

From a practical standpoint, time is closely linked to productivity. Processing difficulties reduce efficiency and quality. Adhering to effective maintenance and control procedures maximize productivity on a continual basis. It's still not enough, however. The practical aspect must be acknowledged and practiced. I can't put it any better than a highly respected gentleman in this industry does. Larry Durney said, "In our industry, many people look, but don't see." When troubleshooting a problem, always keep your cool. As Larry said, "When panic walks in the front door, reason jumps out the window." The following field examples are for your pleasure and benefit.

Electrical Brain Toasters

It helps to keep your humor when electrical problems are involved. Once in physics class, my professor announced that the lecture would center on the Wheatstone Bridge. A wise-guy classmate of mine shot back, "There's a short circuit with electrons backed up over the Wheatstone Bridge."

Left-Right, Right-Left

A brand new computer-automated barrel zinc plating line was installed to replace an old hand line that had paid for itself decades earlier. Pride was etched on every staff member's face. That is, until the first barrel loads of finished screws and mandrels were found to be shiny, wet masses of steel. Computer program and equipment checked out fine. So did chemical analysis of the process baths. Ditto for current to the saddles. The last check proved the most rewarding. The bussing from the rectifiers was traced directly to the tank connections—of course, in reverse. Although this was during the middle of winter, several people looked like they had just returned from a Cancun vacation. Within an hour, that new plating line was doing its intended job: producing quality parts!

Out with the Old, In with the New

A decorative hexavalent chromium tank was replaced, literally, with a new tank and ancillary equipment for a decorative trivalent chromium tank. The new trivalent chrome electrolyte was electrolyzed for several amp hours per gallon. When completed, the dummy sheet was removed, revealing that approximately 75 percent of it had dissolved. In this case, instead of purifying the bath, dummying seems to have artificially aged it several decades. So much so, in fact, that the electrolyte was retired to the great plating line in the second dimension. Again, the problem was reversed bussing cable. As soon as this was corrected, a new electrolyte passed the test and was an instant hit.

Wheel of Fortune

Speaking of chrome, the hexavalent type is really sensitive to AC ripple—even 0.5 percent can make it downright ornery. Parts were exiting a decorative hexavalent chrome tank with sporadic whitewash. The problem seemed to "come and go" and the rejects rate increased dramatically. Having a wrong perception of the problem, "chemistry was thrown at it"—a dash of barium carbonate, followed by a drop of sulfuric acid, dummied to reduce trivalent chromium, added sugar to make trivalent chromium, changed the rinses, added chromic acid to the rinses ... and so on. After two weeks, they called the rectifier serviceman. Five minutes after troubleshooting with his oscilloscope, the diagnosis was AC ripple. Appropriate rectifier repairs were made and the problem disappeared.

Stop the World, I Want to Get Off

Automatic return-type machines are always fun. One tale involves hazy nickel deposit. Parts would enter station one, transfer along four stations and exit from station five. After "throwing some chemistry at the problem," a tong tester confirmed that station two was dead. In fact, the parts were anodically etching in station two. After cleaning and greasing the contacts, all five stations were in sync with electrical readings and the problem was eliminated.

Around & Around We Go

Parts exiting a decorative trivalent chrome tank had a misplate shading on the leading face. After "throwing some chemistry at the problem" and soliciting advice from long-lost plating "experts," the Durney method of analysis was used. There was a bipolar effect on parts entering station one. To eliminate it, a small rectifier was connected to the first station. Parts now entered the plating tank "live," neatly eliminating this bipolar effect. A little juice is better than no juice.

Inside-Out

Suddenly, a new batch of steel parts were plating with a dull nickel finish on the exterior face. Admittedly, "a little chemistry was thrown at the problem." Once satisfied that the chemical balance was good and there were no electrical glitches, the raw material steel was evaluated. The account purchases steel coil with one side polished and the other matte. In fabrication, the part was designed to be stamped with the polished side in the exterior. Inside-out predicted a reverse scenario.

Bon Appetit!

Barrel nickel plating of steel fasteners was a snap, except for the first load after lunch every day. While monitoring the process, it was confirmed that the plater would place a few barrel loads in the nickel bath just before lunch each day. He would let the barrels rotate during lunch without any current. A shot of "juice" every day at noon was found to prevent further heartburn.

Cup Runneth Over

For some reason, a nickel bath was plating a progressively duller deposit. Coincidentally, the solution color seemed to lighten a bit. Hull cell tests indicated a continued, urgent need for brightener, well beyond the normal consumption rate. A check for leaks confirmed all was shipshape. In one one steamy corner of the tank, however, an innocent-looking hose was pulled out. It was continually gushing a stream of water.

Black or Green

One nickel bath suddenly exhibited all the classic symptoms of severe zinc contamination. The problem was that this bath only plated over steel parts. Things only got worse as the zinc contaminant level quickly rose above 150 ppm. The line was shut down. Everything was checked. The nickel anode baskets were emptied, revealing some "black pearls" disguised as zinc anodes. The boss said, "I'll fire the guy who did this." A few hours later, he admitted that he couldn't fire himself.

Poison to the Last Drop

On a per-shift basis, an assigned operator would make all the required maintenance additions to the process baths. He matched add tickets to the specific additions. One mix-up cost a line 12 hours of downtime. Just three gallons of zinc brightener were added to a 4,000-gallon trivalent chrome bath, instantly shutting it down. It took the standard "best friends" of batch treatment—hydrogen peroxide, carbon filtration and dummying—to get the bath running again. In fact, the deposit never looked better. An accident resulted in a nicely cleaned up process bath. It now had a "new solution" profile.

Wanted: Dead or Alive

One particular cycle consisted of hard chrome plating zincated aluminum parts. The desired chrome thickness and adhesion met specifications. Suddenly, peelers ruled. This time, chemistry was not thrown at the problem. Instead, each step was methodically checked, the operating parameters were confirmed and baths analyzed. The last step in the line was the culprit. A new operator was assigned to chrome plate. He forgot to switch on the rectifier before the parts entered the bath. This was enough time for the chromic acid solution to significantly attack the zincate film. Using live entry with current to the parts before entering the bath corrected the problem.

The AESF Can Provide Answers

Small problems are a warning to take action before they escalate into really big, nasty, expensive ones. Don't expect miracles—use a methodical approach to check every item related to the problem: cycle, process tanks, rinsing, electric, equipment, racks or barrels, parts and fabrication and, most importantly, the observations of people directly involved. Make a note of how a problem was solved, because it might strike again. Communicate with associates and friends at AESF meetings. Someone always has timely advice or firsthand experience that will be helpful.

Mail Bag

A reader asked the following question:

I need some information on how to improve the corrosion resistance of the hard chrome coating I am currently applying to the ID of some steel tubing that has stainless steel ends inertia-welded to them. The tubing is approximately 4 in. dia. x 48 in. long. Is there any documentation on duplex chrome that is honed between finishes, or on high-temperature (crack-free) chrome, followed by regular chrome?

I forwarded this question to a large chromium chemistry supplier and received the following reply:

To my knowledge, there is nothing in any reviewed journal or probably anywhere else about duplex chromium, and very little about crack-free. It's probably because neither of these is a good deposit for any corrosion-related application. Duplex chromium is a layer of crack-free chromium, followed by a layer of hard chrome. The crack-free is soft, but as long as it is crack free, the corrosion (NSST) is super. The hard chrome gives wear resistance. It's a wonderful concept, which is still used by a few people to get past the NSST acceptance tests. The problem is that, while it is fairly easy to plate crack-free chrome, it is impossible (so far) to keep it in that state. There exists enough residual stresses is the crack-free deposit so that the first time additional stress of any type is applied to the part, the deposit will form large cracks from top to bottom. In the case of duplex chromium, the cracks will usually extend through the hard chrome layer. Even if they don't, however, with the crack you get a point source for all the corrosion current … and guess what's worse than no chrome?

Back in the early days of chromium for decorative applications, the duplex system was developed for automatic uses. The NSST was fantastic. When it was first used for bumpers in field trials, however, it lasted until the first rock. In hard chromium plating, the best corrosion resistance is obtained from baths giving the largest number of microcracks. The more cracks, the shorter they are, so the penetration along them has a greater number of discontinuities. Also, with more cracks, the corrosion potential is spread over a larger area and, therefore, the corrosion current at any given spot will be lower—just like microporous chromium for decorative plating. Of commercial chemistries available, the conventional system has the fewest microcracks, followed by the mixed-catalyst fluoride system. That is why the mixed-catalyst systems have so much success. If the plater wants additional corrosion resistance over the current mixed-catalyst chrome system, a deposit of sulfamate nickel or electroless nickel (depending on specific application) could be applied. P&SF

Think Tank Trivia

- Alkaline soak cleaners **not** containing caustic soda are recommended for removing chlorinated oils. In the presence of caustic, chlorinated oils tend to congeal, forming a jellied mass that resists removal from the base metal surface. High detergency, silicated soak cleaners are recommended for this application.
- There is no benefit to adding an iron control agent to an already heavily contaminated bright nickel plating bath. Most iron control agents will redissolve the precipitated iron sludges that may be coating anode bags, along tank walls, etc. The iron is chemically reduced from its insoluble trivalent state to a soluble, complexed divalent species, which gradually plates out. A high-pH batch treatment is preferred to remove the iron contaminant. Then, initiate maintenance additions of the iron control agent to the cleaned nickel bath.
- There are significant process control differences between iron and zinc phosphate systems. Iron phosphates are readily controlled by pH measurement and titration of acidity to determine product concentration. Zinc phosphates include some complex control procedures: Analyze total and free acid (developing a ratio), determine iron content and activator.