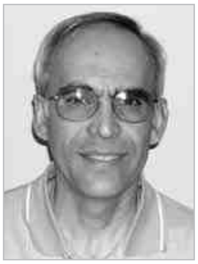

Troubleshooting Tips & Observations: Surface Preparation

Stephen F. Rudy, CEF
Hubbard-Hall Inc.
563 South Leonard Street
Waterbury, CT 06708
E-mail: sfrudy@optonline.net

The metal finishing industry is interesting and unique in many ways. One aspect is the valuable experience we gain through identifying problems, changes, modifications and overall improvements that usually occur. Many of us probably have a "card file" of these practical situations. Recalling past troubleshooting work may help to run down future problems quicker or to eliminate repeat problems. In some instances, the culprit may have been obvious, overlooked or required some in depth detective work. The following situations are some of the many surface preparations problems that I have experienced over the years.

Soak Cleaning

- A new bath makeup of the normally dependable cleaner was no longer removing the usual oils and grease. This line had been shut down and the soak- and electrocleaner were both made up new. The problem was that the electrocleaner was used to make up both tanks.

- In another mix up, the newly made up electrocleaner did not provide the usual conductivity to support the required voltage. In fact, some steel parts were etching and forming brown spots (a sign of insufficient caustic). Checking the maintenance log, it was confirmed the soak cleaner was inadvertently used to make up the new electrocleaner solution.

- A metal stamper routinely contracted a plater to process their parts. Suddenly the plater could not clean the oils off the parts. Dumping the cleaner, rinses and acid did not correct the problem. Since nothing in the plater's operation had changed, he turned to the stamper for assistance. By conducting a check, the stamper's purchasing department had switched from the usual water soluble oil to a chlorinated paraffin. The problem was easily corrected by returning to the water soluble oil. The plater's caustic-based cleaner was reacting with the chlorinated paraffin, causing it to gel on the surface, instead of removing it.

- During the work day, the nickel plated finish took on a more distinct haze, as time progressed. The nickel bath was analyzed by wet chemistry and Hull cell, and given a clean bill of health. Working up the line and monitoring cleaner bath temperatures, it was found that a solenoid valve controlling the steam inlet to the soak cleaner was sticking. The soak cleaner, usually at 145°F (63°C), was steadily heating up until a dry-on film did form on the parts at 190°F (88°C). This film would not come off in the other tanks and rinses that preceded the nickel bath.

- Nickel plated brass screws were rejected due to insufficient plating in the threads. Inspecting the raw parts confirmed a copious loading of oil in the threads. The current soak cleaner was not removing the oil. Based on testing other candidate soak cleaners, a switch was made to a different blend that removed the oil, permitting nickel plated coverage in the threaded areas.

- Steel parts were plated revealing a sporadic, mottled, etched pattern. The cleaner was not removing grease. Passing down the process line on the parts, the grease coated localized spots, causing a "grease etch" in these small areas.

- Plated zinc die castings were blistering. The blisters peeled right back off the base metal. Examination of the raw parts revealed pitted areas and cold shots. These surface defects were made worse by the caustic containing soak cleaner etching the parts. This enlarged the pits. Progressing down the line, process solutions and rinses became trapped in these voids. The result was gradual bleed out, resulting in plating blisters. Two corrections were made. The casting and buffing operations were improved and the soak cleaner was changed to a non-caustic blend.

- Aluminum parts were processed in a standard barrel acid tin plating cycle. Suddenly, blisters occurred and could not be prevented. All the process tanks were replaced with new makeups as were the rinses. The problem was found to be in the raw incoming aluminum coil, now being received with waxed sheets wrapped around the coil. The coils were stored outside in the sun, causing the wax to soften. Inside the building, the wax hardened up, forming a tenacious film on the aluminum.

Electrocleaning

- Barrel plated parts were exhibiting corrosive pits. By carefully following the line, it was found that residual hydrochloric acid was dragging into the electrocleaner (soak — rinse — acid — rinse — electroclean — rinse — acid). In the electrocleaner, chloride was oxidizing as chlorine gas bubbles on the surface of the parts, forming the corrosive pits. The problem was solved by improving the quality of rinsing and switching to an electrocleaner especially inhibited to prevent this type of corrosive pitting.

- Racks processed parts in a double cleaning cycle were found to have the same corrosive pits as in the previous barrel line problem. It was the same chloride contamination problem. But it was only occurring in the second electrocleaner, following the first hydrochloric acid, in a double cleaning cycle.

- Nickel and chromium plated parts exhibited periodic blistering. The ongoing problem was traced to the electrocleaner. With every pass of the racks, chromium was anodically stripped in the electrocleaner. The buildup of hexavalent chromium was passivating the steel. This coincided with the electrocleaner solution color progressively turning more yellow and losing its foaming characteristics. The addition of a proprietary reducing agent, corrected the problem without having to prematurely dump the electrocleaner. Hexavalent chromium was chemically reduced to its trivalent state, forming insoluble chromium (III) hydroxide precipitate.

- Zinc die castings exited the electrocleaner with white corrosive patches. The wrong electrocleaner formulation was used. Switching to a moderate caustic blend, fortified with silicate buffer eliminated the problem.

- Brass parts were dezincified, resulting in pink patches. Changing to a properly formulated electrocleaner for brass eliminated this problem.

- During a maintenance shutdown, the electrocleaner tank was thoroughly serviced. Upon startup, the solution seemed to rapidly age, as per unusual smut development on the parts. After running for a while, it was found that as the cleaner had to be dumped. Someone noticed the bussing had been reversed during maintenance. The problem was plating a metallic smut film on the parts that were now negatively charged.

Acid activation

- Nickel plated wire goods were being reprocessed due to nickel plating rejects. The parts were cycled around the machine a second time. A cathodic acid would be followed by an immersion acid, and parts would be typically re-nickel plated. This time, the new deposit peeled badly. During reprocessing, someone forgot to strip the post-nickel lacquer coating. Once this step was incorporated, the nickel replates were fine.

- The hydrochloric acid solution was economical, but just could not provide a reasonable bath service life. Post plate haze and blisters were traced back to the acid. Continued dipping of copper hooks and flight bars in the acid gradually increased the copper concentration, resulting in an immersion copper on the steel parts. This was eliminated by adding an inhibitor to the acid to prevent the immersion copper problem.

- Alkaline zinc plated stainless steel wire parts exhibited dullness and patches of blisters. The surface preparation cycle consisted of double cleaning, Woods strike and alkaline zinc. The basis metal had surface cracks from the extrusion process. Hydrochloric acid penetrated these fissures and cracks, raising smuts. Changing to a sulfuric acid and fluoride solution reduced base metal attack and minimized smutting. This eliminated the plating problem.

- Zinc die cast parts were smutty after an acid dip. The result was a hazy and somewhat rough copper deposit. The 1% sulfuric acid dip was replaced with a proprietary sulfamic acid and fluoride solution, which left the parts smut-free. This corrected the copper deposit.

- One set of brass stampings nickel plated fine. Another set plated with nickel blisters. The assay of each basis metal confirmed 0.25% lead in the alloy of the easy to plate parts. The bad parts contained 3% lead. The hydrochloric acid dip was changed to a sulfuric acid and fluoride solution. The fluoride in particular was required to dissolve the lead smut. Followup nickel plating was equally good for both sets of alloy brass parts.

- Series 380 aluminum castings were routinely desmutted with good success in a universal tri-acid, consisting of 50% nitric acid, 25% sulfuric acid, 25% water and 8 oz/gal ammonium bifluoride. The fabricator switched to series 413 castings. This resulted in plating blisters. The concentration of ammonium bifluoride was doubled to correct this problem. Series 380 contains 7 to 9% silicon, whereas series 413 contains 11 to 13% silicon.

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