Shop Talk

Some Production Plating Problems & How They Were Solved—Part 17

Collected and edited by Fred J. Kaim Compiled and updated by Dr. James H. Lindsay, AESF Fellow

The first eight of these stories were contributed by the members of the Upper Midwest Branch of the AES, and collected and edited by Mr. Fred J. Kaim, of Superior Plating, in Minneapolis, Minnesota. Interestingly, some of these involved painting applications as well as plating applications. As then *Plating* Technical Editor, Dr. Frederick A. Lowenheim wrote when this collection was first published, "Many of these problems reflect their source: northern Minnesota. 'Room temperature' can, at times, be 'rheum temperature.' We sincerely hope that our colleagues in the Upper Midwest Branch are not experiencing these difficulties during this balmy May weather." Keep in mind that this was published in "balmy May" rather than the chilly January that you are enduring in 2005.

1. In painting cabinets, fish eyes developed sporadically. Checking for oils or other surface contaminants in the phosphate and rinses prior to painting gave no answer. It was finally noted that most fish eyes were on two sides of the cabinet during a particularly heavy rash. Following through the plant in the reverse direction of predominant air currents, we came upon the welding department, which was periodically using a silicone spray. After isolating this operation from the painting operation, all fish eyes ceased.

2. In painting white and pastels, we noted periodically a darkening of the paint film. New batches of the same paints were tried. All spray equipment was thoroughly cleaned. Special attention was given to the paint mix room to be certain someone wasn't stirring the whites with a paddle having black paint on it. The problem still came and went as it desired. Then in February, a particularly great change in color occurred from a white to a very light grey. Finally checking the oven, a carbon smut was noted on horizontal members. Checking the gas burners, it was noted that the flame indicated a lack of oxygen. No changes had been made in fan speeds or damper controls. Then one of the "problem team" went out on the roof and found the exhaust to be partially covered with snow (This is Minnesota-not Florida.). Raising the exhaust outlet eliminated the trouble, of course.

3. In producing a dull chromate coating on close tolerance small parts, we could not achieve the desired dullness and stay within tolerance, using the normal clean—etch rinse—desmut—rinse—chromate—rinse cycle. Altering temperatures and times in the various baths did not produce the desired clean-looking full chromate film within the allowed dimensions. Finally, unorthodox sequences were tried. The system of clean—rinse—desmut—rinse etch—rinse—desmut (for a few seconds)—rinse—chromate—rinse gave the desired finish and the result was within tolerance. It seems the nitric acid component of the desmutter removes the oxide thoroughly without attacking the aluminum. This allows a uniform attack in the etch and cuts down the required etch time.

4. In painting a five-sided box, constructed by welding sheet to an angle-iron frame, the adhesion of the paint to the exterior was excellent but almost zero on the interior of the box. Checking the operation through the cleaningphosphating line revealed no area where the two surfaces were being treated differently. It was all a dip tank operation with no hand operation on the interior. Baking times, temperature and circulation of heat within the box were all checked so as to give the same cure inside as outside. Looking at the construction convinced us that the capillary action between the angle iron and the sheet steel welded to it prevented proper rinsing. Swabbing the interior with a dilute phosphoric acid solution removed the contamination and adhesion was good. Merely using good agitation in the final acidified rinse after phosphating would not remove this contaminant, which we believe was the wetting agent in the cleaner spreading from the area with the capillary condition between the time of phosphating and painting. (Designers - please take note.)

5. In a copper-nickel-chromium line for zinc die castings, chromium contamination of both the copper and nickel became a constant problem. Covering the entire layout, except the chromium tank, with white paper, showed no lack of proper ventilation. Production was continued only with the continued use of chromium control compounds. Installation of a chromium strip and cleaner for all racks prior to reuse did not help. Making a set of racks for chromium only and reracking between nickel and chromium gave no solution of the problem. Several months later, while washing a barrel outdoors, a slight yellow cast in the water was noted. A check showed 5 ppm of chromium in the water. Further checks pinpointed the source of chromium as Well No. 1, while Well No. 2 was clear. A change of plumbing so that all rinses and makeup water for the entire process up to the chromium plate were

Based on an original article from the "Plating Topics" series [*Plating*, **55**, 474 (May 1968)]

supplied by Well No. 2 and the chromium and subsequent rinses by Well No. 1 finally cleared up the problem. Discussions with various people finally pinpointed the source of contamination of Well No. 1. During the previous Fall, an outside storage tank for a chromium solution, near Well No. 1, had developed a leak, allowing several thousand gallons of chromium solution to seep into the well. (*Imagine the implications of this today – JHL*)

6. In a plastic pretreatment line, massive skipping developed relatively suddenly. Analysis of all solutions involved showed they were within tolerance limits, chemically. A study of parts showed that the shelf surfaces of the parts were the areas that skipped almost completely, and the parts on the top of racks the greatest offenders, with constant improvement in coverage as we proceeded toward the bottom of the rack. This definitely indicated some type of contaminant on the surface of a solution-most likely an oily material. Yet no discolorations could be seen on any surfaces. All rinses and chemical baths were overflowed nevertheless, with no improvement. Discussions with all involved in this line brought out the fact that one of the maintenance people had applied a "penetrating oil" to a part of the hoist mechanism over the "etch solution." Making a gallon of new etch in the laboratory, but using production line solutions for the rest of the sequence, produced good parts. Adding one drop of the penetrating oil produced the same defect as the production department had. Dumping, thoroughly washing with caustic, rinsing with dilute chromic acid, and making a new etch solution put the production department back in business.

7. The problem was to plate cadmium to a minimum of 12.5 μ m (0.5 mil) on any area of a five-sided box, paint the interior and exterior and have a high gloss finish, with no bulging thickness or nodules at the sharp edges of the top of the box. The first attempt was to shield the top edges using plastic sheet, and place internal anodes in each corner. This produced a fair job, except the minimum thickness of cadmium was not met in the interior corner area, and the exterior thickness was too high and presented a matte spongy surface, which gave a dull paint finish. Rubber tubes were then attached to the sides of each internal anode with the outlet at the bottom, and solution was pumped through the tubes in all four corners, and the current density was increased. This gave better uniformity on the interior but the exterior still presented too dull a finish after painting. Finally, the interior anodes were connected to one rectifier and the external anodes of the tank proper to another. Using a low current density for the exterior areas and high current density for the interior produced the desired result.

8. The problem was to plate 12.7 μ m (0.5 mil) of hard chromium on an ABS wheel type part. The first attempt at solving the problem was to plate 15.2 μ m (0.6 mil) of acid copper, 7.6 μ m (0.3 mil) of bright nickel and 12.7 μ m (0.5 mil) of chromium. The stress of the chromium literally tore the wheel apart. The second attempt was 10.2 μ m (0.4 mil) of copper, 5.1 μ m (0.2 mil) of highly-purified Watts nickel, followed by the 12.7 μ m (0.5 mil) chromium. The results were much better, but the plating was still cracked. The next attempt was 10.2 μ m (0.4 mil) of copper, 7.6 μ m (0.3 mil) of reverse stressed nickel, and 12.7 μ m (0.5 mil) of chromium. The result was satisfactory.

9. Dull rhodium

The customer complained about dull rhodium over silver in barrel plating. Asked if he was activating the silver, he said that he was. He was trying to plate 0.76 μ m (30 millionths) of rhodium over silver. The customer insisted that the silver was OK. He thought the rhodium was bad. After several phone calls, trying all different approaches with the rhodium, I decided to visit his plant to see what was causing the trouble. The parts were very dull. I told the operator to run another load and to call me when the parts were ready after silver plating. Upon examination, the parts were bright. I told the operator to go ahead and process the silver plated parts as he always did. The first step was two cold water rinses [10°C (50°F)], sulfuric acid dip, cold water rinse, a DI water rinse and rhodium plate. This is what some people call activating silver. To solve the problem, after the cold water rinses, we went through a hot electrocleaner (no current) and a warm water rinse. The rest of the cycle was the same. I became a hero. The problem was that the brighteners left on the surface of the silver-plated parts were being frozen owing to the extreme cold water rinses. Consequently the rhodium was being deposited over a microscopic film. Hence, a dull deposit was produced.

William Rothstein, Technic, Inc. Chicago, Illinois

10. Poor throwing power

The customer complained about poor throwing power with his gold solution. I told the customer over telephone that I thought it was related to low metal content, and that he should put in a couple of ounces of gold. However, he insisted the gold solution was being maintained by the laboratory at exactly the same concentration as they always did. As all good peddlers say, "The customer is always right." Being out of town, I flew up to visit his plant to try to straighten out his problem. The customer was correct (I said the customer is always right). The problem still was poor throwing power. The gold was not covering nickel plated parts. However, he neglected to tell me he was operating the gold solution at room temperature, which was 15°C (60°F). The job was flash gold over nickel and had to be of uniform color. To correct the problem we first raised the temperature to 32-38°C (90-100°F). We then put in the two ounces of gold. Then we plated another part and it came out perfect. The total time to correct the problem was five minutes in the plant and a two-hour round trip airplane ride, excluding the drive to and from the airport. Room temperature does vary from plant to plant, anywhere from 10-27°C (50-80°F), and if you only recommend room temperature, that's it. Our Technical Data Sheets say that room temperature is 21-38°C (70-100°F). I insist, if you do not succeed, read the supplier's technical data sheets. That's why they have them printed.

William Rothstein, Technic, Inc. Chicago, Illinois

Tech Editor's Note: The edited preceding article is based on material first compiled and contributed by Dr. Samuel Heiman, as part of the "Plating Topics" series that ran in this journal. It dealt with everyday production plating problems in the late 1960s, many of which are still encountered in the opening years of the 21st century. Much has changed ... but not that much. The reader may benefit both from the information here and the historical perspective as well. For many, it is fascinating to see the analysis required to troubleshoot problems that might be second nature today. In some cases here, words were altered for context.