

## Some Production Plating Problems & How They Were Solved—Part 8

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Based on an original article from the "Plating Topics" series [*Plating*, 53, 1343 (November 1966)]

### 1. Hard Chromium—Peeling

In our hard chromium department, we sometimes plate heavy thicknesses, in excess of 0.254 mm (10 mils), on both new parts and salvage work. Also, we sometimes interrupt the chromium plating in order to check the thickness and continue plating, when we find that further deposition is required.

Occasionally, in subsequent grinding operations, these parts peeled; in some cases, between the first and second plate, and in others, from the basis metal. This was particularly true when the grinding was performed by someone not normally used to grinding chromium.

To alleviate the peeling problem, we began grit-blasting all parts, which required a final grinding operation, before plating them. We also grit-blasted the parts if more plating was to be added. We use a 150-grit aluminum oxide which gives a fine matte finish. The blasting equipment is a small portable unit which has a 3/8-in. I. D. hose, and operates at 517 kPa (75 psi) pressure. After blasting, we blow off the loose grit from the rigging and the surface of the part to be plated.

A typical steel part is etched and plated in our 250 g/L (33 oz/gal) chromic acid, 100:1 ratio bath in the conventional manner. The bath temperature is 52 to 54°C (125 to 130°F) and the current density is about 32.3 A/dm<sup>2</sup> (300 amp/ft<sup>2</sup>).

A part which requires more chromium plate is handled as follows. Etching (back plating) is started at the lowest possible voltage. The voltage is then raised slowly to three-fourths of the amount used in plating. The etching time is three minutes minimum or until uniform gassing is observed. We then begin plating at the lowest possible voltage for 3 to 5 minutes and increase the current by 20% of the final value in five steps at 5-minute intervals. This takes about 30 minutes to reach the required current density.

The grit-blasting certainly adds to the cost, but since adopting this step, we have had just about 100% success in eliminating peeling.

*James E. Wooten, Simmons Plating Works, Inc. Atlanta, Ga.*

### 2. Cleaning Carbon from Stainless Steel

#### **Problem:**

**Remove what soil:** carbon.

**From what part(s):** stainless steel flame shields on DC-6's and DC-Ts.

**In what type of equipment:** mild steel tank.

**Prior to what subsequent operation:** replacement on aircraft.

#### **Former method:**

Various strippers and manual wire brushing. This was quite

unsatisfactory in both the effectiveness of the cleaning and the manpower required.

#### **Solution:**

An alkaline deruster at 240 g/L (2 lb/gal), 60°C (140°F) or higher.

#### **Results:**

Fantastic. The entire labor force was tremendously impressed as was the administrative group. This method has been recommended for the West Coast operation.

### 3. Cadmium Plating—Dull Deposits

#### **Problem:**

Loss of brightness in the cadmium plate over the entire current density range. Dipping in nitric acid or clear chromate bright dips did not brighten the dull deposits. There was no other harmful effect noticed such as loss of throwing power, loss of plating rate or burning.

#### **Attack:**

The bath analysis was OK. The plating conditions were normal. Nothing unusual was seen in the cleaning method, basis metal or tank operation.

The following additions were successively made to the plating solution:

1. Sodium cyanide: up to 22 g/L (3 oz/gal).
2. Sodium hydroxide: up to 11 g/L (1.5 oz/gal).
3. Proprietary brightener: up to one-half of the original make-up.

In troubleshooting a brightness problem, there is a tendency to go overboard in brightener additions. However, an overdose of brightener in a plating bath may not only not solve the problem, but may cause other troubles, such as loss in throwing power or a shift in the bright range. Therefore, if the addition of the proprietary brightener in the amount mentioned above does not improve the brightness, one has to look elsewhere for the cause of the trouble. In this case, none of the above additions improved the brightness of the plating.

#### **Solution:**

The addition of sodium polysulfide (about 1.6 mL of 35% solution per 100 L or 1.0 fluid oz. per 500 gal) resulted in an immediate restoration of brightness. Sulfide solutions which are used to "purify" zinc plating baths are equally effective.

## Comments:

Owing to recent changes and improvements in manufacturing procedures, some brands of sodium cyanide available in the United States are free from sulfur "impurities." The brightening mechanism is probably related to the presence of this sulfur for which the above plating bath was starved. More research in this field is certainly indicated.

As seen here, very little sulfide is needed to serve the purpose. An excess of sulfide does no harm but is wasteful since it precipitates cadmium sulfide.

*Charles Geltzahler, Platers' Technical Service, Inc. Chicago, IL.*

## 4. Plating and the Weather

The experienced plating "skipper" not only takes care of his solutions and equipment but also takes into account the effect of weather on his operations.

Hot, humid weather in the summer invariably brings on a rash of "spotting out" on cadmium plate, particularly on parts with seams or porosity. This is usually due to the absorption of water from the air by plating solution residues which have not been completely rinsed off or rinsed out of the pores. Special attention to the rinsing is therefore indicated at these times, as well as thorough drying of the parts.

On one occasion, we had a rash of problems in our plating shop. After considerable investigation, we found that the trouble was caused by the wind! When the wind was just right (or wrong!), it would blow the exhaust from the chromium plating tank in through the shop windows, which were open in the summer for comfort. The chromic acid settled on several copper and nickel tanks.

In another similar case, we had a problem with "fish eyes" in paint films which were caused by the exhaust from a vapor degreaser coming back in through open windows.

The weather, however, can also be a useful ally, particularly in the removal by the "freezing-out" method of carbonates from sodium cyanide-containing plating solutions. In the fall, these solutions are checked for carbonate content. Then we begin to watch the weather forecasts for predictions of a cold snap over a week end, preferably when the temperature will go down to -10 to -6°C (15 to 20°F) on both Saturday and Sunday nights. The solution is pumped to a storage tank out-of-doors on Friday night and returned to the plating tank (which in the meantime has been cleaned out and refurbished) early Monday morning. This treatment brings the carbonate content down to about 22 to 38 g/L (3 to 5 oz/gal) and, with proper operation of the tank, it will last till the following fall before carbonate removal is again required.

## 5. Quality Control—Care of Equipment

In the course of a vendor surveillance check, I recently visited a plating shop located in the heart of Pennsylvania Dutch country. The industrious and prosperous people in this area still retain many of the customs of their ancestors who came to this country a couple of hundred years ago and speak as their second language a German dialect which contains many English words.

I was particularly impressed not only by the well stocked quality control equipment which they had but also by the excellent condition and working order of this equipment. One good reason for this could have been the following sign which was posted above the equipment.

### *Achtung!*

Das machine und equipment is nicht fur gefingerpoken und mittelgrabben. Ist easy schnappen der springenwerk, blowenfusen, und poppencorken mit spitzzensparken. Ist nicht fur gewerken by das dummkopfen. Das rubbernecken sightseeren keepen hands in das pockets relaxen und watch das blinkenlights.

## 6. Anodizing Magnesium—Equipment

This problem may be stated quite simply. A steel plate coil in our DOW 17 DC anodizing tank leaked after less than a month in ser-

vice. Furthermore, a considerable amount of the solution was lost through the leaks in the coil by siphoning action.

The anodizing solution does not attack steel chemically. The plate coil had been connected to the steel tank which serves as cathode in the anodizing process. It had been assumed that the coil would thus be further protected.

It was found that the leaks, as well as extensive attack, occurred only at the welds in the plate coils. There were no leaks or attack at the welds in the tank. Also, examination of the plate coil showed that arcing between the work and the coil had not occurred.

A new plate coil was installed and it was decided to insulate this plate coil electrically from the tank and from the plate coils of the neighboring tanks by phenolic pipe sections and Teflon® spacers. This solved the problem. The plate coil is still OK after several years of operation.

It is felt that the leak may have occurred because the coil became anodic thru stray currents originating from other tanks. This conclusion was arrived at by the process of elimination. It was not possible to isolate the path of the stray currents but this appears to be the only reason which can be logically advanced.

**Technical Editor's note:** *The edited preceding article [Plating, 53, 1343 (November 1966)] is based on material 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 mid-1960s, many of which are still encountered in the opening years of the 21<sup>st</sup> 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.*