Some Production Plating Problems & How They Were Solved—Part 19

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1. Tracking down bi-polar nickel "peelers"

It is sometimes difficult to establish exactly where in a nickel plating rack the bi-polar condition or current interruption responsible for peelers is occurring. This is especially true in return type automatics where the racks travel through the nickel plating tanks. Whenever a nickel solution is operated at high voltage and low anode area, one of the problems can be bi-polarity and peelers become a possibility.

Locating the point at which bi-polarity or current interruption occurs is usually the most difficult part in solving the problem, as the voltage-geometry relation can then be changed to minimize the difficulty.

A 12-V automobile light bulb with two leads having alligator clips for attachment will reveal the location of these conditions in the following manner. Attach one light lead to the plating arm and the other to the rack. If at any time during the plating cycle, contact is broken between rack and arm or cathode bar, the bulb will light. During a high voltage, low anode area plating cycle, any break in cathode contact can lead to bi-polar peelers. A dead plating rack represents a shorter electrical path for the current from remote anodes to a rack trying to draw full current, which is physically near the disconnected rack. The side of the disconnected rack next to the active rack will become anodic and thus passivate the nickel surface.

Another prevalent bi-polar condition results from entry and exit procedures in nickel plating. If the voltage difference between a "plating" rack and an entering or exiting rack is too great, bi-polarity can easily occur even if a hot lead is used. Exit bi-polarity from the nickel tank will make chromium smears because of anodic passivation of the nickel. This occurs frequently in hand lines as well as automatics. Anything exceeding 4 to 5V or distances closer than 20 cm (~8 in.) between racks represents a potential bi- polar condition.

With a double-lead light and a voltmeter, peelers due to bi-polarity can be traced to a current break at a specific location, which can then be corrected to eliminate the effects.

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2. Don't take meter readings for granted

Dial type thermometers, especially those associated with temperature controls, are frequently installed in abusive environments and, after various lengths of time, become inaccurate. All continuously reading thermometers should be checked weekly against a standard glass laboratory thermometer. The cases of trouble due to unquestioned reliance on indicating-controllers are too numerous to mention and many troubleshooting calls are made to investigate problems which would not occur if instruments were checked on a schedule … a five-minute job.

Lawrence A. Phillips

3. Are your ammeters accurate?

At minimum, the accuracy of ammeters should be checked annually and more often if for any reason they have suffered overload, which can ruin a shunt. Plating thickness, and thus anode usage, brightener additions and general control of any plating solution, depend on accurate ammeter readings. There are many meters whose accuracy is never questioned from year to year. Considering the cost of inaccuracy, it makes sense to have a periodic check.

For each 1000 A going into a nickel bath, nickel is consumed at 1.1 kg/hr (2.4 lb/hr). Projected over 200 working days this is equal to 1700 kg/yr (3840 lb/yr). Even an inaccuracy of 5% would mean 87 kg/yr (192 lb/yr) per 1000 A of operating current.

If a reading is falsely high or low, brightener additions based on ampere-hours will be affected and result in poor work from too high or too low concentration levels. It makes economic sense to check meters.

Lawrence A. Phillips

4. "Chicken tracks" in a chromium deposit

Periodically, a phenomenon occurs in a decorative chromium deposit over bright nickel that can best be described as "chicken tracks." This defect is a random gray spottiness varying in size from pinpoint to 0.3 cm (1/8 in) in width. The "tracks" are usually elongated and somewhat selective in that they are more pronounced when fluoride-containing chromium solutions are part of the plating cycle.

The gray spots cannot be removed by the conventional color wiping salvage operation. Buffing to remove the defect results in cutting through the chromium, exposing the underlying nickel layer.

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The defect is caused by chromic acid mist carried by air currents over the plating installation. The mist settles on the bright nickel deposit during transfer, producing localized nickel passivation.

An insect spray gun (Flit gun) has been found to be highly effective in reproducing the problem.

Elimination of this problem can be accomplished by the use of compatible mist and fume suppressants in the chromium solution and re-directing the air flow over the installation.

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5. Simple auxiliary anode for chromium plating

The use of auxiliary anodes in chromium plating poses a major problem in getting them positioned so that they do not cause burning, yet close enough so that they do their job. A simple auxiliary anode which may be of interest to job shop bumper platers can be made using an "L" shaped piece of 1-in. diameter PVC pipe, in which 0.5-in. diameter holes 3 in. apart have been drilled on the under side of the short leg. A length of lead rod equal to the length of plastic pipe is inserted in the pipe. A battery cable and clip are connected to the lead rod.

After the part has been placed in the chromium solution, the auxiliary anode can be hooked to the anode rail using the battery clip. The long leg of the "L" becomes the handle and the short side can be moved over the part. The plastic pipe allows the operator to touch the part as he moves the auxiliary anode along the low current density areas of the part without causing burning or a short circuit. The 0.5-in. diameter holes allow sufficient current to flow for chromium coverage.

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6. On the job plating test

From time to time, the plating super visor in a bumper plating operation may wish to check the steel or any part of the cycle prior to plating. This can be done by using a 6-in. wide piece of shim stock which is 0.002 in. thick, has an extremely good finish, and can be formed easily around a racked bumper and subsequently processed.

This will provide a piece of metal which has not been prepared by the standard processing in the plant. The operator can then plate this section, and make comparisons between this and the regular production. Since both pieces are plated under the same conditions, some conclusions can be made for the preplate cycle and in some cases the actual plating cycle. Although the test has been used successfully on bumpers, it should be easily adaptable to other parts.

Fred M. Dixon

7. Consumption rate of addition agents

The consumption of many (not all) brighteners and leveling agents, depends primarily on the effective concentration, the area being plated and time, if it is diffusion controlled. The effective concentration will depend not only on the actual concentration, but also on temperature and agitation. Only to a much lesser extent is it dependent on current density. For example, the consumption of a brightener per hour may be the same at 2.1 A/dm^2 (20 A/ft^2) as at 6.4 A/dm^2 (60 A/ft^2). Also, the consumption rate will be doubled if the operating concentration is doubled. The consumption rate of a brightener or leveling agent, therefore, is best expressed as gallons per ft^2 of cathode area per hour. Note that "amperes" does not enter into this expression. Why then does a supplier express consumption rate as gallons per 1000 A-hr or A-hr per gallon?

The answer is that the supplier has to assume that a nominal concentration and constant current density are to be used. If the tank is only half-loaded, the area being plated will only be half normal and it is then assumed that only half the normal current (amperes) is being used. With these assumptions, it can be seen that the use of "A-hr per gallon" is satisfactory. When it is remembered that consumption rate is dependent on concentration, agitation and temperature, and assumptions have been made regarding current density, it should not be surprising that the consumption rate value given by the supplier can vary greatly from the actual.

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***Technical 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.*