Advice & Counsel



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What's Decorative ... And What's Not?

The last few articles on the chromium emission regulations under the Clean Air Act have resulted in some interesting questions I would like to share with readers:

Dear Advice & Counsel,

Our company performs black chromium plating over bright nickel on automobile antennas. We are very concerned about information in your article on the chromium emission regulations, which indicates that black chromium plating is going to be regulated as a hard chromium plating process. This would prevent us from complying through the use of surfaceactive agents to achieve compliance, and would require us to perform stack testing. Why is our process considered to be hard chromium plating, when it is so similar to conventional decorative chromium plating? Signed,

Black Widow

Dear Widow,

The answer to your question lies in the definition the U.S. Environmental Protection Agency (EPA) created for decorative vs. hard chromium plating, as well as comments provided by industry to the agency in response to the publication of the proposed regulations.

The EPA defines decorative and hard chromium plating as follows:

Decorative Chromium Plating—The process by which a thin layer of chromium (typically 0.003–2.5 microns) is electroplated on a base metal, plastic, or undercoating to provide a bright surface with wear and tarnish resistance. In this process, the part serves as the cathode in the electrolytic cell and the solution serves as the electrolyte. The typical current densities applied during this process range from 540 to 2,400 A/m² for total plating times ranging between 0.5 to 5 min.

Hard Chromium Plating/Industrial Chromium Plating—The process by which a thick layer of chromium (typically 1.3-760 microns) is electrodeposited on a base material to provide a surface with functional properties, such as wear resistance, a low coefficient of friction, hardness, and corrosion resistance. In this process, the part serves as the cathode in the electrolytic cell and the solution serves as the electrolyte. Hard chromium plating processes are typically performed at current densities ranging from 1,600 to 6,500 A/m^2 for total plating times ranging from 20 min to 36 hr, depending upon the desired plating thickness.

Note to those who are not "metrified": 0.003–2.5 microns is less than one-millionth to approximately 100-millionths of an inch; 1.3– 760 microns is approximately 50millionths to 30-thousandths of an inch; 540–2,400 A/m² is 50–223 A/ft²; 1,600–6,500 A/m² is 150–600 A/ft².

One Small Voice ...

The issue of what category black chromium plating falls into was not addressed in the regulations. EPA discussed the issue in response to a comment it received, on page 4952 of *Federal Register*, Vol. 60, No. 16, dated January 25, 1995 (third column, top). Excerpts are as follows:

"One commenter pointed out a distinction among decorative chromium electroplating processes: Black chromium and white chromium. The commenter stated that black chromium electroplating is more like hard chromium electroplating in terms of process parameters, and the commenter recommended that black chromium electroplating be subject to the same requirements as hard chromium electroplating processes. ...

"... Regardless of what name a facility has assigned to its processes, for the purposes of the regulation, the process will be regulated according to its function, bath operating parameters, and desired plating characteristics. Therefore, black decorative chromium electroplaters would likely be subject to the standards for hard chromium electroplaters based on plating characteristics. The EPA will provide states with guidance on these types of applicability issues in the enabling document."

What we have here is one person's comment causing trouble for an entire industry by his/her misguided and misinformed information to EPA. The fact is, there are a variety of black chromium plating processes, including one that is similar to hard chromium plating.

Decorative ... or Not?

In the 1960s, the military used a black chromium plating process for coating rocket rail launchers, interior surfaces of optical parts, and parts of small arms. The process was covered by military specification MIL-C-14538(MR). The specification calls for plating at 40-90 A/ft², which is considerably below the current densities used for conventional decorative chromium plating (120-220 A/ft^2). The process, however, calls for approximately 0.0002-in. of plating, which requires a plating time of 30-45 min. Based on the thickness/ plating time, I would consider this to be "hard chromium" plating, despite the low current density.

An article written by Art Logozzo*, a prominent plater of hard chromium, refers to the same military process, and also a patented process called the "Graham" process. The Graham process is said to operate at current densities ranging from 150–450 A/ft². The high end of this range would exceed the current density in the definition of decorative chromium plating, and I believe this is the type of process the commenter brought to EPA's attention as operating at high current densities. The article, however, refers to applying this coating over regular hard chromium to give the surface the appearance of an "oxide finish." This would, therefore, be a "decorative" application, because the deposit is very thin and is applied mainly for appearance purposes. The plating time, while not indicated in the article, would be similar to conventional decorative chromium plating.

The supplier of the majority of the black chromium plating processes in the U.S. confirms that its process has little wear resistance, compared to what one would obtain from hard chromium, that the process operates at 1-2 ASI (144-288 A/ft²), and that it is typically applied over a period of up to 5 min at at thickness level ranging from 5-20 millionths of an inch, which is identical to conventional decorative chromium plating. Literature on the process does indicate that the process is capable of plating at current densities as high as 400 A/ft², which would exceed the EPA definition for decorative plating. The plating time indicated in the literature, however, is 45–180 seconds.

In summary, it is clear that black chromium can be plated as either a

thick, hard deposit, or as a thin, decorative deposit—just like conventional chromium. The defining factor should be the deposit thickness and the nature of the plating operation (intermittent short times on the order of a few seconds to 5 min vs. long periods of 30 min or more).

This information has been submitted to Lalit Banker of the EPA (author of the regulations), and he has assured me that EPA will utilize this information in its guidance document to the states.

Dear Advice & Counsel,

We are a very small job shop that utilizes a trivalent chromium plating process over bright nickel on furniture parts. We can't believe that EPA wants us to fill out a Title V Air Permit for this process—it doesn't even require ventilation! What goes on here?

Signed, Frustrated

Dear Frustrated,

EPA *did* publish a Title V Air Permit requirement for **all regulated facilities** in the final regulations. This would include your company. While at the time of this writing I am not at liberty to divulge details, my advice to you is to not do anything regarding applying for a Title V Air Permit for any decorative chromium process for the short term. Representatives of the NAFM/AESF/MFSA Government Advisory Committee have met with EPA regarding this requirement, and a possible revision to the regulation is imminent. Platers of hard chromium are given the same advice. Those facilities that are applying for a Title V permit for other emission sources should proceed and should include their chromium plating operations in the application.

*Art Logozzo (Nutmeg Chrome Corp.), "Chromium Plating," *Metal Finishing Guidebook Directory for 1970*, p. 256. Metals and Plastics Publications, Inc., Hackensack, NJ.

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Registration deadline: May 10 See page 129 for details.