New York State Environmental Facilities Corporation

Measuring Surface Tension of Chrome Plating Baths

April 02, 2002

by Stephen Mohr

Based on information the PROGRAM obtained at a DEC workshop, it appears that certain measuring instruments approved for use in compliance monitoring under the National Emissions Standards for Chromium Emissions from Hard and Decorative Chromium Electroplating (chrome NESHAP) may be more prone to error than others. DEC raised this subject during an August workshop to review the requirements of the chrome plating regulation with regional staff. PROGRAM staff were invited to attend.

At the workshop, a regional DEC staff person explained that a company they had inspected as part of an ongoing enforcement action was having trouble maintaining the surface tension on their decorative chrome plating baths in accordance with the chrome NESHAP's requirements. Facilities that opt to use a surfactant type fume/mist suppressant as their emission control technology must keep the surface tension under 45 dynes per centimeter.

The plater complained of having to add the surfactant frequently, up to 1 gallon each month, to keep the surface tension readings under 45 dynes/cm. He was concerned that the surface tension readings continued to stay near or even slightly over 45 dynes/cm (exceeding the limit is a clear violation of the regulation). He was also concerned about the expense of the surfactant solution. The plater was using a stalagmometer to measure/monitor the surface tension, which is one of the approved methods in the chrome NESHAP.

The company hired a consultant, who initially tested other surfactants and sent plating bath samples to the surfactant manufacturer, suspecting chemical interferences or incompatibility. After confirming that the problem was not attributed to the surfactant, the consultant suspected that the stalagmometer might be giving falsely high readings and suggested using a more-accurate, but also significantly more-expensive, instrument called a tensiometer.

START SIDE BAR
This problem has also been documented in an interim report from a joint study done by industry and the federal government called the "Hard Chrome Pollution Prevention Demonstration Project," published in November 1996. One aspect of the project involved a comparison of surface tension readings taken on the same sample with both instruments and showed that the margin of error for measurements obtained using the stalagmometer was significantly higher than for those taken with the tensiometer. This comparison also showed that the margin of error, up to 22 dynes/cm, was greatest at higher surface tensions.
END SIDE BAR

As it turned out, the tensiometer yielded considerably lower surface tension readings, which in turn has allowed the facility to substantially reduce the frequent additions of surfactant solution to the baths. Overall usage is down approximately 80%, which translated to a savings of close to $1000 per year in operating costs. The company owner's anxiety level has also dropped substantially as he now feels more confident that they are complying with the regulation.

Sounds like a winner, right? Well maybe, but there are some things to consider carefully before making a similar move at your plating facility. First, although the tensiometer is likely to provide more-accurate and reliable readings, this instrument ranges in price from approximately $2,500 to $3,000, compared with a stalagmometer which typically sells for $150 to $200. However, the surfactant products typically sell for approximately $150/gallon. If your facility has multiple baths, excessive and unnecessary usage of a surfactant due to inaccurate (high) readings with a stalagmometer could add up to significant operating costs. In addition, maintaining higher concentrations of the surfactant due to inaccurate surface tension readings could, in some cases, result in pitting problems with the chrome finish if the facility is doing thicker hard chrome plating.

From a regulatory standpoint, all exceedances of the surface tension limit must be recorded and kept with other

required records on site for 5 years. An exceedance also has the immediate effect of putting a facility back on a more-frequent, every 4 hours vs. every 40 hours, compliance monitoring schedule under the chrome NESHAP. Therefore, erroneous readings can certainly lead to potential enforcement liabilities and additional staff time devoted to compliance measurements and recordkeeping.

If you have concerns about taking surface tension measurements, contact the SBEAP and we will provide you with the latest information from industry and the regulators on this issue. A hard chrome help manual is also being developed by the EPA and the metal finishing subcommittee; it is expected to be finalized before the end of the year.