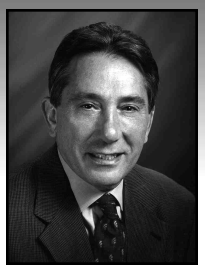

Standards Report

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On Metallic & Other Inorganic Coatings

A Generic Method of Specifying Coatings

The Real World

The last time I had a tooth pulled I was 10 years old. I bled for 24 hours before it dawned on me that I needed to go back to the dentist. He packed the hole in my gum with some medicated gauze and solved my immediate problem, but there's still a gap where the molar used to be. Friends tell me that getting customers or purchasers to specify requirements for coatings is like that. The information has to be forcibly extracted, the process can be unpleasant, and at the end of the day, something is missing.

I've seen coating requirements specified as follows on engineering drawings, usually in the lower right hand corner where the notes are: *nickel plate per ASTM B 456* or *electroless nickel plate per ASTM B 733* or *anodize per ASTM B 580*. Anyone familiar with those technical standards knows that citing the number is not enough. Consider the following:

- ASTM B 456 covers decorative, electroplated nickel-plus-chromium coatings. Those coatings can be single-, double- or triple-layered; the total nickel thickness can vary from 10 µm to 35 µm on steel and differs for other basis metals; the chromium can be conventional, microporous or microcracked; and the appearance can be bright, satin or semi-bright.
- Electroless nickel deposits may contain from 1–>10-percent phosphorus, the thickness can be 0.1 µm to 75 µm, and the coatings may need to be heat treated to improve adhesion, to increase hardness and wear resistance,

and/or to lower the risk of hydrogen embrittlement.
- The anodic oxide coatings on aluminum specified in ASTM B 580 can be 1 µm to 50 µm thick, and supplementary treatments may be required.

So, besides the number, the appearance, type and thickness of the coatings, as well as baking, supplementary treatments and other operations, have to be specified, taking into consideration expected service conditions. The specific alloy to be coated should be known because that determines how the material is prepared for plating, as well as whether hydrogen embrittlement-relief heat treatments before or after plating are required. In addition, the quality control tests included in most coating standards need to be specified to verify that essential requirements have been satisfied.

In an ideal world, the purchaser or customer would always provide the plater with a written, detailed product specification as part of the purchase order or contract, using all the appropriate technical standards as guidance, and the product specification would be referenced on the part drawing. I don't know whether that's common practice in the real world, but it should be.

How Coatings Are Specified in Standards

A quick look at how coatings are specified in some technical standards explains why some member countries of ISO/TC 107 and its European counterpart, CEN/TC 262, are pushing for a standard, generic method of specifying metallic and other inorganic coatings. Examples of current specifications are as follows:

- ASTM B 766 designates the *class* and *type* of electroplated cadmium coatings. *Class* designates the thickness of the coating and *type*, supplementary treatments (*i.e.*, type of conversion coating).
- The electroless nickel standard, ASTM B 733, designates the *type*, *service condition number*, and *class* of the coating. *Type* specifies the phosphorus content of the coating, the *service condition number* specifies the minimum coating thickness as related to the severity of the intended service, and *class* designates post-heat treatment requirements.
- The standard on palladium-nickel alloy electrodeposits, ASTM B 867, specifies coating *type*, *class* and *grade*. *Type* designates the nickel content of the alloy coating, *class* the thickness of the coating and *grade* specifies the thickness and type of gold over-plate.
- ASTM B 456 designates *service condition* and *coating classification numbers* for nickel-plus-chromium coatings. For example, for service condition number 5 (extended, very severe service, such as encountered by exterior components of automobiles), the corresponding coating classification number is either Fe/Ni35d Cr mc or Fe/Ni35d Cr mp. Those alphanumeric strings designate the basis metal (Fe), a 35-µm-thick nickel coating (Ni) that is double- or triple-layered (d), and a topcoat of chromium (Cr) that is either microcracked (mc) or microporous (mp).

There are, therefore, two methods of specifying metallic coatings. One is based on designating the coating *class, type* and *grade.* The other is based on specifying *service condition and coating classification numbers*.

The fact that the terms *class, type,* and *grade* are not used consistently in all coating standards creates confusion. What may be more important is that designating electroless nickel, for example, as a Type IV, SC 3, Class 2 coating does not provide much information (unless you memorize the standard or have a copy of it handy). The alphanumeric string or classification number is more explicit. The electroless nickel coating just referred to would be designated as follows: Electroless Nickel ASTM B 733 – Fe/Ni-P(7)25[HT(385)1] where Type IV is equivalent to Ni-P(7), that is, a nickel-phosphorus alloy coating with seven-percent phosphorus; the SC 3 is equivalent to a coating thickness of 25 µm; Class 2 is equivalent to [HT(385)1], that is, heat treatment at 385° C for one hour after the coating is applied. Note that the sequence of symbols corresponds to the order in which the coatings are applied or the operations are performed.

The First Generic Standard

CEN/TC 262 has already developed a generic standard, EN 1403:1998, Corrosion *protection of metals—Electrodeposited coatings—Method of specifying general requirements*. The heart of that European regional standard is the designation clause that is similar to the alphanumeric string or classification number described in the preceding paragraph. The hope is that this will reduce the need for reproducing clauses for general requirements in each coating standard and eventually eliminate inconsistencies. This method is reportedly now being used by automotive and plumbing supply companies in Europe and the U.S. and is becoming popular.

In the interim, ISO/TC 107/SC3, *Electrodeposited coatings and related finishes*, is designating coatings in each individual standard in very much the same way. There are some inconsistencies, however, and the method being used by TC 107/SC 3 is not exactly like the one specified in EN 1403. As a result, TC 107 has been asked to issue a new work item to develop an international standard that is identical or equivalent to EN 1403. Not everyone in Europe believes that is worth doing because of fear that the method will be misinterpreted or misused. That fear arises from the fact that the designation method does not replace or eliminate the need for the detailed product specification mentioned above. That is one of the topics on the agenda of our next committee meeting.

What Do You Think?

A generic method of specifying metallic and other inorganic coatings might be useful if it contained comprehensive checklists to guide the preparation of the written, detailed product specification.

If you have an opinion about this, don't hesitate to contact me by e-mail (gdibari@inco.com). (Don't send me any viruses, please.)

Our committee has a new website and you can log on as a guest to learn what's going on (http://isotc.iso.ch/livelink/livelink). After you log on, look for ISO/TC 107, *Metallic and other inorganic coatings*, on the ISOTC home page. It's new, so we are still posting information, but in time it will be a good source of information on the activities of ISO/TC 107, its subcommittees and working groups. P&SF