Hands-on Management

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Decorative Coatings & the Ever-changing World of Surface Finishing

This month, I'd like to talk about a decorative finish that all of us see and maybe even use every day, but may not be familiar with how it is applied. First, however, let me (as we say in Philly) "axe youse guys" a question: What distinguishes a decorative coating from any other type of coating?

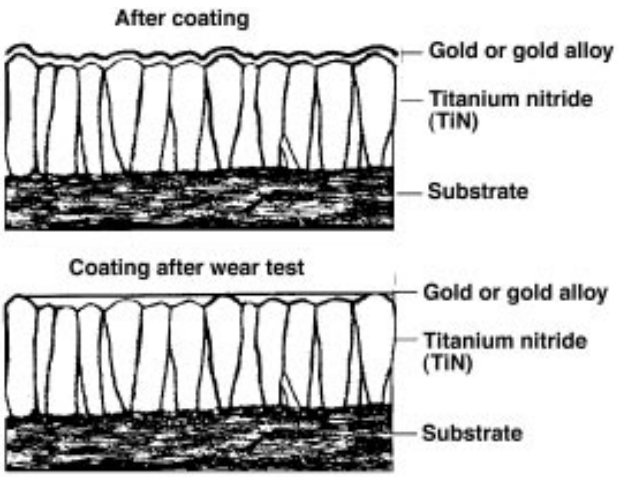
Lowenheim's *Electroplating*[1] points to features that very loosely separate deposited metals into six categories:

1. Sacrificial coatings—preserve the base metal, which is usually iron or steel, by electrochemically corroding before the substrate.
2. Decorative coatings—generally added on top of protective qualities to create a pleasing appearance.
3. Engineering coatings—used for the distinct properties they confer to the surface: softness (to form a gas-tight seal), solderable, conductive and many other functions.
4. Minor metals—easy to plate, but limited in application, such as cobalt.
5. "Unusual" metals—rarely electrodeposited, requiring special conditions, such as aluminum.
6. Alloys—one of the fastest-growing areas in finishing, as more alloys attain commercial importance every day.

Obviously, there are many overlaps in this listing. Today's alloy finishes, for example, can be listed as both sacrificial and decorative.

Time to Answer the Question

What is it that identifies a decorative coating from the other categories? A decorative coating **must** be pleasing to the eye. This answer may seem a little too subjective, even vague, but maybe it can explain a few of the great mysteries of "acceptable" finishing. Such as the "rejects" we get the day after our customer's incoming inspector of 20 years retires. Or, the incredible fight that tri-chrome—with all of its benefits—is slowly winning to gain market share over that manly two-wheeled blue-bright of hex-chrome in the purely decorative area.



After a period of wear, the gold top layer remains over most of the TiN layer, because the super-hard micro peaks prevent further erosion of the softer layer.

Color is important. Do you remember the first time you saw the gold color on the ends of high-speed twist drills? That is titanium-nitride (TiN), a very hard, gold-colored film introduced into industrial applications as a wear-resistant coating for tools. It didn't take long before someone got the inspiration to use this material in decorative applications.

"One of the first applications for decorative coatings developed in Japan in the late '70s was in the field of watch parts. For these substrates, gold-colored films are very important. Nowadays, the combination of a hard titanium nitride underlayer with a gold or gold alloy topcoat is the industrial standard."[2]

TiN is applied with a vacuum technology called sputter ion plating. Depending on the economics, the process works either as a batch- or in-line-type vacuum deposition system. Production costs for a typical 0.5 μm (0.00002 in.) TiN and 0.1 μm (0.000004 in., or about the thickness of a gold strike) gold topcoat has about the same overall cost as the coating it replaces—1.5–2.0 μm (0.00008 in.) electroplated 18-carat gold. Gold covers the titanium nitride and achieves a reproducible warm gold color that is controlled using Swiss standards for color tones.

The major advantage over electroplated gold is wear resistance. In the

Taber abrasion test, the gold/TiN film lost 10–100 times less volume than the electroplated coating on the watchcases. This means the film will meet, at a minimum, the same wear resistance as a 5 µm electroplated gold coating and can last 10 times longer.

Usually, a soft metal deposited over a hard material would wear off fairly quickly, but not in this case. As the gold film wears (see figure), the vast majority of surface area continues to be gold-covered when the tops of the peaks of titanium nitride (also gold-colored) are reached. The craggy micro peaks prevent the softer gold film from wearing further.

You can find this high-tech coating on everything from watch parts, eyeglass frames and pen barrels to door handles and faucets.

New Technologies & the AESF

This article is sort of a microcosm of the electroplating industry and, in some ways, the AESF. While new technologies have replaced traditional electroplating in some areas, the same changes have created finishing opportunities in other areas. Finishers are learning to change with the times by adding these new technologies in their shops, so they can offer choices in plating *and* surface finishing.

AESF can take advantage of these same opportunities by recruiting individuals from all areas of the surface finishing industry. Then, by forming and supporting new committees and encouraging forums for these alternative technologies, the Society can offer additional benefits to these new members. The boundary lines within our industry are becoming less defined, and membership in the AESF offers benefits that cannot be found anywhere else. It is imperative that we get the word out to these potential members.

The finishing industry is not diminishing—it's just changing, and we need to keep up with it. P&SF

References

1. Frederick A. Lowenheim, *Electroplating*, McGraw-Hill Book Co., p. 169.
2. Uwe Kopacz, "New Trends in Decorative Coatings," *Metal Finishing*, December 1992.

Editor's Note: *Use the AESF membership application on p. 55 to join the Society and start taking advantage of the many benefits offered. If you are already an AESF member, share this issue of* P&SF *with a co-worker.*