Designing a Better Finish

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With a little understanding of the dynamics of electroplating, designers can get better results in their finished products

"All that glitters is not gold." That's because a lot of it is gold plated. From earrings to bracelets to brooches, gold covers a variety of base metals. But how is this gold applied?

The gold effect is achieved by electroplating, a process that may have been in use over 2,000 years ago. While there is some debate whether electroplating is a science or an art, it was the scientist Michael Faraday who discovered electromagnetic induction in the early 1800s and laid the groundwork for modern electroplating techniques.

Simply, gold electroplating is the electrolytic application of a gold layer to an otherwise complete object. Although the primary function of the gold is decorative, it also adds other features, such as tarnish resistance and durability.

Advances in the art - or the science - of plating have made it possible to produce thicker gold applications. Complicated forms can be coated with greater uniformity. There are formulas for achieving plated colors that match the traditional color values of various gold karatages.

The quality of gold electroplating plays an important role in the aesthetic success of jewelry. And by understanding the plating process, jewelry designers can get the most out of their finished products.

The Plating Process

High-quality jewelry typically is plated by the rack method, where the product is fastened to a metal rack and then submerged in a plating solution. The solution carries microscopic ions of metal that are plated onto the product when the rack is negatively charged. For plating to occur, the piece must be made of conductive material and thoroughly cleansed of any material that can obstruct conduction (e.g., oil, paint, lacquer, etc.)

Once cleaning is complete, the plater begins applying different layers of metal. Copper, which promotes adhesion and fills porous areas, usually is the first metal to be plated.

The piece then is most often plated with nickel, which adds brilliance and helps to eliminate porosity with its characteristic leveling powers.

In some instances, acid-copper is used in place of nickel. This is primarily done to comply with emerging European standards that limit or exclude the use of nickel on products exported to certain European countries. Although acid-copper is a successful substitute for nickel, either a palladium or a bronze barrier plate between the acid-copper and the final finish would be needed.

After the nickel or copper deposit, the product is ready for its final finish, which may include common metals such as gold, rhodium, palladium, tin, silver and black nickel, or even an oxide.

Special Finishes

There are several variations to this process that can make the final versions more distinctive.

- *Satin Finish:* This is produced by treating the base metal with a brush-polishing wheel to produce fine lines in the surface.

- *Matte Finish:* This is accomplished by sandblasting or by vibratory finishing prior to plating. Special dull nickels can be applied to coat the product and maintain the matte look.

- *Oxide Finish:* After plating, the piece is immersed in an oxide solution that causes it to turn black or brown. It can then be tumbled or hand-relieved to create an antique effect.

Designing for Plating

A designer once brought me a plating sample that disappointed her because it was bright in some areas and dull in others. I pointed out that the configuration of the design prevented the plating process from covering the piece uniformly.

By paying attention to the geometry of a design, a designer can save a lot of trouble later in the plating room.

Here are some typical challenges for the plater:

- Three-dimensional products create high- and low-current density areas on the product. Three-dimensional items tend to receive and distribute current unevenly. Thus, less plating metal will build in the low-current-density areas than in the high-current-density areas, resulting in a finish that will be dull in some spots and bright in others.

- Hollow items are a "plater's nightmare." Once any solution is trapped inside a hollow item, it is extremely difficult to remove by drying or cleaning. This problem can be overcome by strategically placing drain holes in the product.

- Round items are difficult to fasten onto a rack unless a hole is made in the design. An alternative is barrel plating, a process that involves placing mass quantities of jewelry in a barrel in which electro-deposition occurs. However, the quality of the finish can suffer.

- Deep recesses pose a problem in white-metal casting and with other metals due to the low-current density of the recessed areas, which can result in less plating coverage. If porosity also is present in the recessed area, bleed-out is more likely to occur. Bleed-out happens when insufficient plating coverage allows the base material to oxidize the surface. This problem is exhibited by a dark spot in the recessed area.

Metal Factors

Now let's consider the base metals a jewelry manufacturer may use. This is important, because each commonly used metal has characteristics that cause variables in the electroplating and manufacturing processes. While some base materials are less expensive to use, they may cause problems later during plating. This could be more expensive in the long run.

Here are some things that affect the finish:

- White-metal castings can be very porous and may require considerable copper to seal, as well as hand-polishing prior to plating to achieve a high-quality finish.

- Brass generally has less porosity, so it requires less copper preplating. But, it is more susceptible to staining and clouding in the precleaning cycle of the plating process.

- Zinc requires special cleaning and considerable copper pre-plating to protect it in the highly acidic nickel bath. (Warning: Make sure you tell the plater that it's zinc. Normal or direct metal-cleaning may destroy the item.)

- Steel can be difficult to plate.

Surface oils must be totally removed to assure proper adhesion between the steel and the plating.

Other Considerations

Fabrication methods also can affect the electroplating process. For example, many castings require some kind of pre-finishing, such as tubbing, vibratory finishing or handfinishing, to remove burrs or gates.

The stamping process can leave sharp edges. Again, tubbing or hand-polishing is required.

The photo-etching process utilizes a non-conductive film that must be removed from the piece. Otherwise, plating defects will occur.

Another important consideration is that different metals have different nickel tolerances. For example, a brass ear wire attached to a whitemetal drop may tolerate only a five-minute nickel deposit, while the drop requires 10 minutes to achieve brilliance.

Look out for instances where soldering and excess heat have created oxide scales, which can cause poor adhesion of the plating to the substrate. Flux material also may be left on the piece. If it is not totally removed, it may cause voids or poor adhesion in the plating.

Get to Know Your Plater

Here are a few things designers should keep in mind when discussing a project with a plater.

Process Control: The capabilities of a plater can best be measured by consistency of the finish. Plating consistency can only be achieved by carefully controlling the process, chemistry and equipment involved.

This means the actual plating process must be engineered to provide consistent quality. The plating baths should be analyzed daily in order to maintain a constant level of metals, brighteners and other bath constituents. Also, your plater should employ a routine equipment-maintenance program to ensure optimum operating performance.

As long as process, chemistry and equipment are properly controlled, the quality of your finish should always be consistent.

Quality Control: Although there has been a tremendous emphasis on process control to yield a quality product, quality control plays a major role in determining the effectiveness of the plating process. Your plater should have a complete quality-control system operating on the production floor, including incoming, in-process and final inspections. These inspections provide a constant flow of information for measuring the plating process and its performance.

Plating Thickness: Thicker or heavier deposits of gold give better durability for the jewelry. For best results, a plater should use the most up-to-date chemistry for his process to achieve the desired specification.

How can you be sure you're getting the thickness and uniformity that you specified? By working with an electroplater who uses X-ray fluorescence equipment or similar technology to analyze the thickness and uniformity of the item. This is a key quality-control procedure that designers should know when placing an order.

Color: The electroplater should have a selection of color formulas for gold. For example, a pale yellow finish is created by adding nickel or silver, while rose gold is achieved by adding copper. There are many other formulas.

Once you've approved the color, it should be accurately matched and kept on file. A color-viewing booth is helpful in achieving the same color each time an item is run. The booth's lighting, intensity and angle remain constant to provide the uniform light needed to match colors.

The success or failure of the electroplating process will ultimately determine the success or failure of a jewelry design. By applying a little knowledge about electroplating, designers can be confident their works will achieve a quality finish. *

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