From Jewelry to Eyeglass Frames, Accessories Set Trends in Decorative Finishing

By Michael A. Akaoui

The primary goal of decorative finishing is to make a product that both appeals to the consumer and is durable in the field. Fashion trends often set the pace for decorative finishing, and while designers can conjure up some pretty wild looks, finishers must continually improve bath chemistries and process technology to keep up.

This article examines the changing landscape of fashion finishes and discusses how process technology and bath chemistry have closed the gap between fashion trends and finishing capabilities.

Fashion Trends

Twenty years ago, mainstream decorative finishing rested with the costume jewelry industry, much of which centered around Providence, Rhode Island. Fashion trends were conservative and many of the large costume jewelry manufacturers required only basic decorative finishes, such as bright rhodium or bright gold. The needs of this industry were met if the finisher could provide a few basic but conservative finishes.

During this period, two very important changes occurred. First, the ease of producing conservative styles and the technical simplicity of the finishes allowed these items to be easily and inexpensively reproduced abroad. The threat of imports to the domestic manufacturer had begun to loom on the horizon.

Second—which may have been a blessing in disguise—the jewelry industry became a designer's playing field, and the industry emerged from the conservative blend of traditional jewelry to new and unique designs that required special finishes and finishing techniques.

Products such as eyeglass frames that come in direct contact with the skin can use nickel-free processes to meet European regulations.

For many years the needs of the designer, who predicted the needs of the consumer, could not be consistently met. While traditional oxide finishes could produce trendy antique looks, the process technology was often inconsistent. The oxide/antique finishes were soft, and when handled would mark easily, limiting post-finishing operations. In those days, after tumbling the oxide from the raised surface, the finisher would

Tanury Industries' in-line PVD (sputtering) system is an environmentally clean process that deposits high-wear, thin, decorative films

often use a water-based, dip laquer as a protective coating. This was not a durable finish, however, and it demonstrated poor wearability in the field.

Recognizing the appeal of real silver plating, designers continued to push the envelope. But the industry had no reliable coating to protect silver plate from the tarnishing that would occur in the field.

While the silver trend stayed hot, so did the process problems. As a result, the industry teetered between silver and non-tarnishing rhodium. At this time, clear lacquer was not considered a quality finish, and E-coat was still developmental as a clear protective coating.

In the late 1980s, two trends—nickel-free and matte—rose to the forefront of the finisher's battle.

Decorative finishers struggled with the nickel-free process and the problem of substituting acid copper for nickel as a leveler. Also, because the process for nickel-free was not well developed, it could result in clouding and burning if the base material had not been perfect. A key to the problem was that process technology was not yet well developed either, because advances in tank design and sparging did not come until later in the decade.

The matte finishing story was perhaps more troublesome for the decorative finisher. Keep in mind that the word *dull* was usually a buzzword for a rejected order. Platers who were used to applying beautiful, shiny, decorative finishes found themselves using chemical technology more appropriate for the electronics industry in order to achieve the desired matte look. The designers knew exactly what look they wanted, and they got it, sometimes!

Companies such as Tanury Industries, Lincoln, RI, learned that a combination of improvements could advance decorative finishing to achieve the "trendy" finishes. Soon what was learned became applicable to other industries that had a need for decorative finishes …with one twist. These new markets had requirements beyond those of the jewelry industry: The finish needed to last, to look beautiful and unique, and it had to meet field demands for corrosion.

So far we have discussed the more important trends and issues placed in front of the decorative finisher for the last two decades. Improvements in process technology, however, are what have allowed the finisher to successfully and consistently achieve the desired "looks."

Antique Finishes

While antique finishes have remained popular, the process of creating an antique finish has developed to a point where the finish can be widely used in a variety of markets—from jewelry to eyewear to lighting fixtures. Today, there are numerous ways to create antique finishes with plating and post-treatment processes. The one most commonly used by large jobshops is a black nickel/satin relieve process.

Antique copper, brass, bronze, silver or pewter (nickel) finishes can be created easily and with great consistency by utilizing black nickel over the primary finish, and then satin-relieving the black down to the base color. This brushed look is very popular and, unlike the oxides, works well in post-finish operations such as satin. Most important is that this reliable process offers very high yields, is compatible with post-finish operations (such as E-coat) and produces a high-quality, durable product.

Silver Plating

As previously discussed, silver was the look most designers wanted. Department stores, however, dreaded the finish because it tarnished easily on the shelves—even when anti-tarnish had been applied!

Plating pure silver was a real challenge to the metal finisher. The process had a tendency to cloud at higher thicknesses or as the temperature rose. It also needed to be compatible with the cure cycle of the protective coating—in this example, E-coat, which required a high-temperature cure.

Technical advances in the brightener systems expanded operating parameters and allowed for greater thickness deposits without the clouding. Chiller systems developed for silver processes have helped to avoid the temperature spikes, especially in the summer months when plating-room temperatures can exceed 100 °F. To complete the improvements the silver and E-coat processes were married, and a non-cyanide silver system was developed that would both prevent tarnishing and withstand the heat of the cure cycle.

By the mid 1990s, decorative finishers had developed a silver/E-coat process that aesthetically appealed to the designer and had field wearability for the consumer.

Protective Coatings

The development of the E-coat process was long and almost damaging to the process's reputation. At its inception, E-coat was riddled with production problems, which ranged from orange peel to over-building thickness.

Thickness was a critical issue, because excessive deposits had a devastating effect on products such as chains. Conversely, inadequate coverage caused products like eyewear to fail in the field. Also, the stability of the bath and its sensitive components made troubleshooting and analysis almost impossible.

In the early 1990s, the process was refined to include a more stable solvent system, making bath maintenance easier and more predictable. In addition, methods that had been developed to test for solids resulted in better control over film thickness.

Although E-coat was initially an essential component in the development of a successful silver finish, its enhanced wear characteristics made it desirable for even more diverse applications. The refinement of the E-coat process, in particular, provided the decorative finisher with a wider range of process solutions to meet the demands of an ever-expanding marketplace.

Nickel-free

The nickel-free trend was driven by the European medical community, and grew from a concern over a health issue: Skin sensitivity to nickel. It is a trend that is sure to continue, and will probably see debate in the U.S. in the near future.

The few European countries that have adopted laws regarding nickel-free products range in regulation from required labeling to absolute prohibition. These regulations govern products such as jewelry, eyewear and watches—typical products that directly touch the skin.

To comply with the various regulations, many manufacturers that export to Europe have simply converted their traditional lines—those that were plating with nickel—to nickel-free, a process that is usually more expensive and, until recently, less consistent.

Although less than 10 percent of the population is actually affected by nickel sensitivity, the nickel-free debate continued to grow, and decorative platers scrambled to perfect the process.

Finding a substitute for nickel that could act as both a leveler and a migration barrier was no easy task. Most nickel-free processes tried to employ acid copper as a nickel substitute. As mentioned earlier, the development of acid copper as a reliable, decorative process had been challenging. Incorporating it into the more sensitive nickel-free process represented, perhaps, the ultimate challenge.

Various materials were applied over the acid-copper to act as a migration barrier between the highly active copper base and the typically thin final finish. Barrier plates such as bronze or tin, which were commonly used in other applications, met with limited success.

By far the most successful barrier between the acid copper layer and the final finish was palladium, which provided both a cloud-free deposit and a corrosion barrier that took a formerly unstable process and created a high degree of consistency.

The palladium nickel-free process can be used on jewelry, eyewear, watches and any other item where the price-point can carry the cost of two precious materials (palladium as the barrier and gold as the final layer). Again, process technology answered the call.

Matte Finishes

The matte finish story is an interesting one. The refinement of the matte process couples many elements of the finishing industry, and in the final analysis is a compromise.

As mentioned earlier, the decorative plater—in pursuit of a perfect matte finish that could be applied to a variety of substrates—employed technology that went beyond the traditional scope. The word "dull" had become a positive, and to achieve it, the decorative plater borrowed process chemistries from other plating disciplines that had little or no brightener systems.

In order to create a uniform finish, however, the base material needed a consistent pre-finish—a vibratory process that would produce a matte or dull appearance.

The search for the right vibratory media became the next hurdle in the development process. Today, the metal finisher uses a wide array of abrasive media to help create a suitable and consistent pre-finish. While several hand operations can also produce matte finishes, the mass vibratory process is the most cost effective.

A high-speed rotary finisher performs excellent base metal preparation for matte finishes.

As jewelry designs and finishes became more intricate, platers needed to develop more sophisticated processes and technology.

The unique part of matte finishing is the creativity a plater can employ to determine the degree of finish. By either varying the time elements of the plating process or combining matte and bright processes, a variety of subtle semi-matte finishes can be produced.

And the compromise that was mentioned earlier? In the final analysis, designers had to realize that there was no such thing as a "perfect" matte finish. Any finish that is a by-product of mass finishing techniques will always result in some degree of variation from piece to piece within a lot.

PVD Coatings

No discussion of trends in decorative finishing could be complete without physical vapor deposition (PVD), commonly referred to as sputtering. A process once used predominately on industrial products—such as drill bits coated with titanium nitride (gold color) to improve the life of the bit—PVD has gone through its own evolution in decorative development.

Not until the mid- to late-1980s did this technology make its way to the decorative playing field. In the beginning, the process was less than decorative and produced a dull, mustard-color deposit. It *was* hard ... but it *looked terrible*!

Transforming an industrial application, which produced hard, thin films that had no appeal to decorative applications, would require a long-term commitment, and several companies began the research.

In the mid-1980s, Tanury Industries began a five-year, decorative thin film research project with Brown University in Rhode Island, which resulted in a prototype system that produced decorative films. The prototype system is still used today and became the model for an in-line production system currently used at Tanury.

Successfully creating decorative PVD films was a challenge that took several years. The applications came first in markets such as writing instruments and watches, where perspiration accelerated the wear phenomenon. Gold-colored PVD films, such as titanium-nitride or zirconium-nitride, provided great wear on these functional items. As the process becomes more consistent, through advances in gas distribution technology and equipment configuration, the applications have grown and will continue to do so.

As in decorative plating, designers will enter a field traditionally dominated by engineers. Once this occurs, the requirements will expand beyond supplying gold and black color finishes (nitrides and oxides) to more unique colors, such as blues, greens and reds. Each time the designer crosses paths with the engineer, the challenge for the decorative finisher begins again. P&SF

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