METAL ROOFING FROM A TO ZINC

ALUMINUM

PART IV: Induced Finishes for Metal

By Rob Haddock

***Editor's note: This is the fourth article in a multi-part series about metal roofing in today's market. The series provides an in-depth look at materials and their uses, coatings, system designs, and installation techniques. It is reprinted with permission of* Metalmag.**

Finishes for special effects

There are numerous reasons for alteration of the surface of sheet metal roofing materials. One is corrosion protection. Another is to make a metal solderable or more compatible metalurgically. Then there are appearance reasons. Of course, the most obvious way to alter a metal's appearance while adding color is to paint it.

Still other treatments are intended to preserve the original mill finish. The post-application of clear protective films to copper sheet and other metals has been attempted for years. But it has had very limited success and is not recommended due to extremely high maintenance costs. There has been success in the mill application of a thin layer of acrylic to Galvalume™-coated steel, which was also discussed in Part II of this series. Unlike the clear film that is intended to protect indefinitely, this is done to protect the natural mill appearance of the metallic coating from staining only during fabrication, handling, and installation.

In other cases, the aesthetic objective of an applied finish is not to preserve, but to mask the natural mill finish. There are a number of ways to do this.

Some trends in architecture tend toward the addition of artificial color films to mask the mill finish. Others are aimed at being "au naturelle," demanding oxidized or otherwise inorganic finishing of natural metals. The latter objective is sometimes a finish that is not an applied film, but rather a mechanically or chemically induced alteration of the metal's surface appearance for aesthetic reasons.

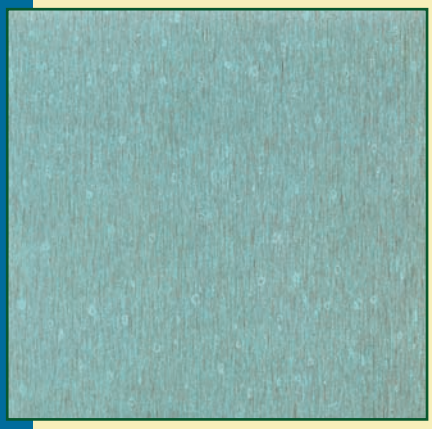
Artificial aging – chemically

Another appearance objective may be to make the metal look aged — weathered and oxidized — even when new. We live in a society that demands push-button results, and a technology age that strives to deliver what the market demands. Food is delivered up piping hot at the drive-up window 90 seconds after it's ordered. And if blue jeans can be artificially aged, why not metal roofs?

Many processes have been developed to give various metals an aged appearance. However, don't expect these mill-induced finishes to have as reliable a color consistency as the natural patination process. Many methods have been used to artificially patinate copper. Field application of different acetic solutions is the least desirable, and often results in unsightly splotches. Because the induced patination is not natural, it will go through a conversion process as nature takes its course. This transition can also be unsightly.

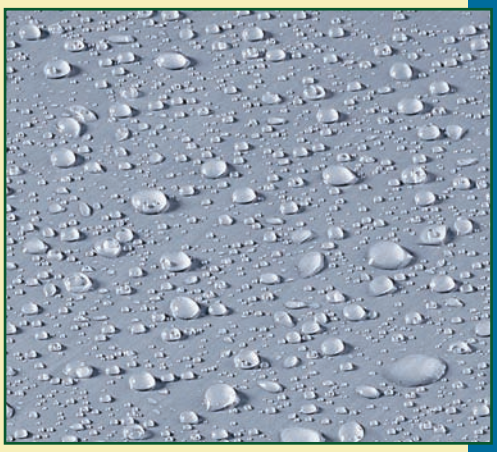
The green/blue color and differing hues found on naturally-aged copper are primarily copper-chloride-hydroxide crystals and copper sulfates that result from sulfurous pollutants in the atmosphere accelerated by heat and moisture. Studies have identified approximately 70 different compounds that may occur in natural patina. The ratio in which these occur depends on moisture and air pollutants, so it varies geographically. Like snowflakes, the crystals all have a unique

The Chrysler Building, an icon of Manhattan, sports a "2B" stainless steel finish.



Left: Some copper mills offer pre-patinated finshes. Revere Copper Products calls theirs EverGreen.

Center: ANTHRA-ZINC is a Umicore finish induced by phosphataic pickling.



Right: RHEINZINK preweathered zinc has the appearance of a directional grain with a subtle blue-gray hue.

and individual shape. Consequently, they reflect and refract light differently, which accounts for the varied hues of aged copper.

While the coveted copper patination process may take 40 years or more in a dry, pollution-free climate, it is chemically launched at some mills to a jackrabbit start before shipping.

Revere Copper Products calls its artificially aged copper EverGreen. The process, while induced, mimics the natural weathering process on an accelerated timetable. It involves chemically and mechanically cleaning copper sheets, preparing the surface for patina growth, application of the patinating solution, then "growing" the patina crystals, which are copper-chloride. The entire process takes about seven to eight weeks. The end product is available in sheet form only (no coils), and conforms to ASTM B-882. The patina when shipped is not fully mature, but will do so as the copper-chloride crystals begin to naturally hydrate upon exposure. As this happens, the hues will change from a yellow-green to more of a blue-green. Although rather recently available here in North America, this patination process has been used in Europe since the 1980s.

Zinc sheet with an aged look is also in demand. So, in addition to natural mill finishes, both Rheinzink and Umicore Building Products (formerly VM Zinc) offer titanium-zinc in a pre-weathered finish. The natural weathering stages of oxidation dull the finish of mill zinc over time, eventually producing a low- or no-gloss deep, matte gray, which results from the formation of zinc carbonate.

Some stainless producers have developed proprietary finishes, some of which are exampled above from AK Steel. Photo, courtesy of AK Steel.

Chemically induced preweathering assimilates the natural weathering process before the material leaves the mill by immersing the metal in a pickling bath of sulfurous- or phosphorus-based solutions. Umicore also produces a product called ANTHRAZINC, induced by phosphataic pickling. The appearance of this finish mimics black slate. Over decades, all of these finishes will gradually yield to a natural, gray-colored zinc carbonate.

While some metals can be artificially aged, Galvalume™ steel is an exception. The material will lose gloss with age, but it is a slow process, taking years. At present, no method to artificially accelerate this aging has been found.

Another chemical process is the anodizing of aluminum. While this is still popular in mechanical and glazing applications, it is going the way of the dinosaur when it comes to exterior architectural metal claddings. This is because

modern paint technologies are superior from cost, consistency, and weathering standpoints.

Mechanically induced finishes

Stainless steel often receives a mechanically induced finish to achieve gloss and/or finish consistency. The finish can either be rolled or polished to achieve a dull or bright finish. The texture of the rolls can also control finish texture. Hot rolling followed by annealing will produce a rough-textured, dull surface, which is designated No. 1.

Cold rolling through unpolished rolls results in a dull finish, which is designated 2D. A bright, reflective finish, which is designated 2B, is accomplished by cold rolling, annealing, and a final pass through polished rolls. An example of this finish can be seen on the Chrysler Building in New York City. Further polishing, brushing, buffing, or grinding can produce even brighter finishes and other textured effects.

Recently, stainless steel producers have introduced several embossed (rolled) finishes with roughened, uniform textures. Trademarked names include "Architex" from J&L Specialty Steel, Inc., and "Graystone Dull" from AK Steel. These finishes offer low gloss, low reflectivity, and enhanced aesthetic appeal for a variety of roofing applications. One high-profile application of this material can be seen on the Ronald Reagan Airport in Washington, D.C.

Other types of mechanically induced finishes achieve textured effects. The most common is embossing, which gives the metal surface an "orange peel" look. The advantage to embossing is to reduce the visual effects of oil canning in the finished product. Embossing is used primarily on coated steel and aluminum. It is often done on-line, either at the end of the paint coating line or at the beginning of the fabrication process. A third-party specialty house can also do it off-line.

The process uses a large cylinder that presses the pattern into the metal as it passes beneath the cylinder.

Because the process can be a bit traumatic to the coating on steel, G-90 is preferred by some over Galvalume™, due to its greater flexibility. It should be noted that "oil canning" effects as discussed in Part I [May 2004 issue, pp. 33] are much more pronounced on high gloss surfaces; hence, induced finishes are more often used to tone down a mill finish, rather than to brighten it.

The topic of profiles and profiling equipment for metals will be covered in the next of this multi-part series.

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