WHITE PAPER

Part 4: Metal Roofing From A (Aluminum) to Z (Zinc)

Induced Finishes for Metal

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 metallurgically. Then, there are also appearance-related reasons. Of course, the most obvious way to alter a metal's appearance (while adding color) is to paint it; however, paint has organic components that degrade over time causing it to fade. (See Part 3, "Paint Finishes for Metal.")

There are other treatments intended to preserve the original mill finish of some metals. 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 discussed in Part 2. 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. By design, the clear coating will dissipate with several years.

In other cases, the aesthetic objective of an applied finish is not to preserve, but to mask the natural mill finish, and there are a number of ways to do this— all varied with the specific base metal in question and its oxide's behavioral characteristics.

So, while some trends in architecture tend toward the addition of artificial color films to mask the mill finish, others are aimed at being au naturel, demanding induced inorganic finishing of natural metals. The latter objective is a finish that is not an applied film, but rather a mechanically or chemically induced alteration of the metal's surface appearance.

Artificial Aging Chemically

One 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 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.

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

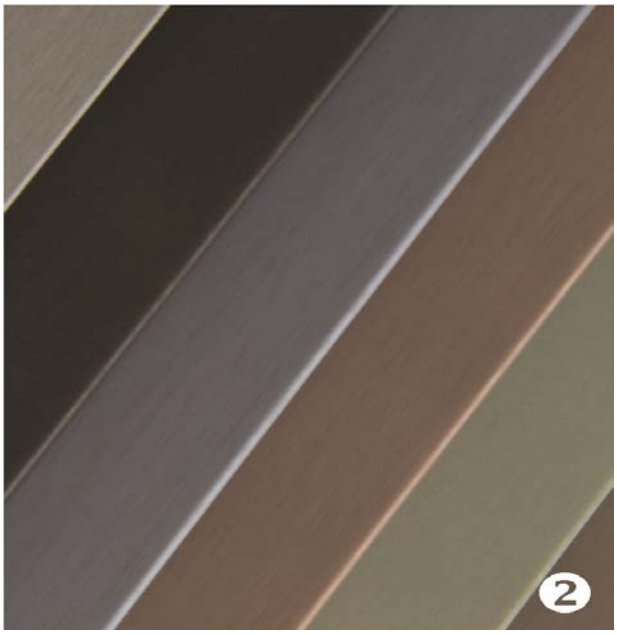
▲ VMZ Double Lock Standing Seam Panels in Pigmento Red from VMZINC were used on the AIA North Carolina chapter building in Raleigh.

However, don't always expect these mill-induced finishes to have as reliable 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 with unsightly splotches. Because the induced patination is not natural, it will go through a conversion process as nature takes its course. This transition can be objectionable.

The green/blue color and differing hues found on naturally aged copper are primarily copper-chloride-hydroxide crystals and copper sulfates and result from sulfurous pollutants in the atmosphere, accelerated by heat and moisture. Studies have identified approximately 70 different compounds that may occur in natural copper 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 and individual shape. Consequently, they reflect and refract light differently, which accounts for the varied hues of aged copper.

When you see marketing for "weathered Galvalume," it is typically a paint coating and not artificial aging of the metal.

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. Induced patination processes have been attempted for many years with only limited success. Prior to the late 1900s, the only tried-and-true patination process for copper was brush-applied horse urine, which produced somewhat splotchy results. Since that time, more sophisticated techniques have (thankfully) come into play.



▲ VMZINC offers (left to right) mill finish, ANTHRA-ZINC and QUARTZINC, in addition to PiGMENTO colored finishes. They all age to natural weathered zinc over time.

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Many processes have been developed to give various metals an aged appearance.

Revere Copper Products has called 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. Revere has taken this product off the market, and we know not whether it will return.

Other copper mills also produce some pre-patina options including KME ("TECU® Patina") and Aurubis Architectural, formerly Luvata, ("Nordic Green™"). Users and designers should always check market availability before specifying any patinated copper products as their introduction to and subsequent removal from the market seems to be the rule rather than the exception. Products that were available last year may not be available next year.

Zinc sheet with an aged look is also in demand. The natural mill finish of zinc has a slight gloss and barely detectable surface grain finish. The natural weathering stages of oxidation dull the mill finish over time, eventually producing a low- or no-gloss deep matte gray, which results from the formation of a protective layer of zinc hydroxylcarbonate that blocks moisture and chemicals from penetrating it.

But for those who don't want to wait for natural aging, chemically induced pre-weathering assimilates the natural oxidation process before the material leaves the mill. This is done by immersing the metal in a sulfurous pickling bath or phosphorus-based solutions. So, in addition to mill finish products, RHEINZINK and Umicore Building Products (VMZINC®) offer varied "pre-weathered" appearance options.

◄Revere Copper Products called their pre-patinated finish ***EverGreen®***.

▼RHEINZINK Preweathered Zinc (center) has the appearance of a directional grain with a subtle blue-gray hue. The mill finished product "Bright Rolled" is at right and the "Graphite Grey" at left.

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VMZINC achieves different appearances with phosphataic solutions that are varied slightly to produce products, called QUARTZ-ZINC® and ANTHRA-ZINC®, the appearance of the latter mimicking black slate. “PIGMENTO” uses pigment technology while retaining the grained texture of pre-weathered zinc. The surface color is created by adding mineral pigments to a durable protective coating, creating organic red, green, blue and brown pre-weathered zincs. Over time, all of these finishes will gradually yield to a natural gray-colored zinc carbonate.

RHEINZINK uses a pickling process for both its pre-weathered products, but then to achieve the darker product, “Graphite-Grey” the sheet alloy is actually altered slightly.

While some metals can be artificially aged, Galvalume steel is an exception. The material will lose gloss slowly over the course of many years. At present, no method to artificially accelerate this aging has been found. When you see marketing for “weathered Galvalume,” it is typically a paint coating and not artificial aging of the metal.

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 to color anodizing from cost, consistency and weathering standpoints. Clear anodizing is still done on architectural products for reasons pertaining more to corrosion resistance and metallurgy, rather than appearance alteration.

Mechanically Induced Finishes

Stainless steel often receives a mechanically induced finish to achieve gloss and/or finish consistency. The finish can 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. 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 “Greystone® Dull” from AK Steel®. These finishes offer low gloss, low reflectivity and

▲ Some stainless producers have developed proprietary finishes, some of which are shown here. *Photo courtesy of AK Steel.*

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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. One reason for embossing may be to reduce the visual effects of oil canning in the finished product. Another may be to reduce the perception of gloss. Embossing is used primarily on coated steel and aluminum. It is often done on-line 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 instead of Galvalume due to its greater flexibility. It should be noted that "oil canning" effects, as discussed in Part I, 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.

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Photos courtesy of Metal Roof Advisory Group, Ltd., Colorado Springs, CO, unless otherwise noted.

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