WHITE PAPER

METAL CONSTRUCTION ASSOCIATION

Part 3: Metal Roofing From A (Aluminum) to Z (Zinc)

Paint Finishes for Metal

A wide variety of paint systems are available for coated steel and aluminum roofing. In this writing, we will look at the basic coating processes and systems that represent the majority of pre-finished applications in metal claddings. In this writing, we will look at the basic coating processes and systems that represent the majority of pre-finished applications in metal claddings.

▲The Sycamore Trails Aquatic Center, Miamisburg, Ohio, features a Snap-Clad (Peterson Aluminum) roof in interstate blue with teal-colored trim.

What Is "Paint"?

In liquid form, paint is comprised of three principal ingredients: resin, pigment and solvent. Pigment and resin are blended in an approximate 50/50 ratio. (The darker the color, the lower the relative pigment content.) The pigment's purpose is to provide color and hiding of the primer and substrate. The resin forms the desired film and binds the coating to the substrate, providing the weather-resistance and durability properties desirable in an architectural coating.

Because pigment and resin materials are solids, they must be dispersed by blending with a solvent. The result is a liquid coating system that can be applied to the metal in coil form. (A solvent is not necessary for powder coatings, but the metal claddings market predominantly uses liquid coating-delivery systems.)

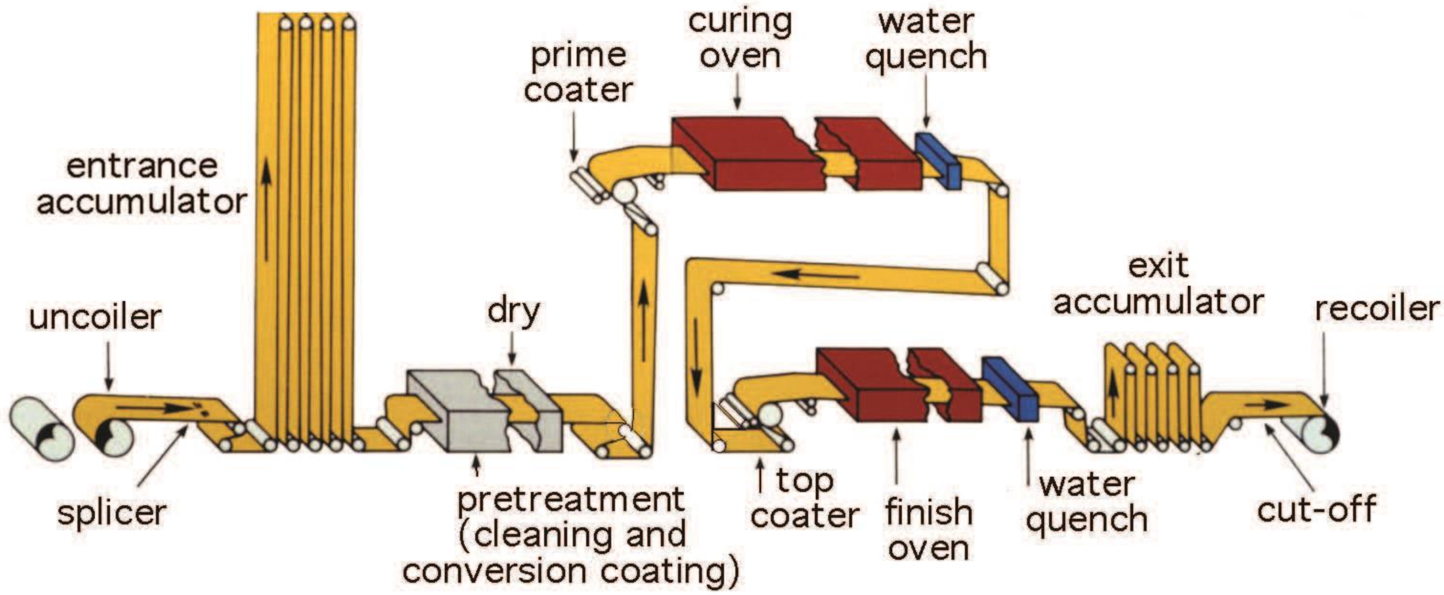
The solvent is therefore the vehicle by which the solids are transported to the panel surface. Although it is more than 50 percent of the volume of liquid paint, it evaporates during the curing process. The resin then becomes a monolithic film that acts as the "glue," holding the pigment particles to the substrate for years to come, surrounding and protecting them from environmental pollutants.

Objectives of Coil Coating

Continuous coil coating is the process used for factory finishing of aluminum and steel panels. Coated steel substrates discussed earlier in this series, including galvanized, Galvalume®, Aluminized and terne, can be coated by this method in a wide range of gauges.

The coil coating method can produce a superior paint finish under controlled conditions and at a relatively low cost per square foot. But the finish must also be durable and flexible enough to withstand the traumas of forming, fabrication, handling and installation. The applied finish must then meet the numerous demands of end use, including aging and weathering appearance criteria while also maintaining adhesion and durability over time.

While it is a common misconception that these type of paint films offer corrosion resistance, they



▲A modern coil coating line represents an investment of tens of millions of dollars and is capable of line speeds up to 800 feet per minute with 72-inch coil widths and material thickness up to 0.135 inch. *Image courtesy of Metal Roof Advisory Group, Ltd.*

may enhance the corrosion performance of the metallic coating when properly applied because they retard galvanic coating loss to some degree.

During coil coating, the flat metal is pulled through automatic processes that clean, chemically pretreat, prime coat, cure, finish coat, cure, cool and rewind—all in a continuous, self-contained, environmentally safe operation. Such automation, when compared to other coating methods, translates into lower costs to the end user. While line speeds can be as fast as 800 feet per minute, normal production speeds of 500 fpm for architectural coatings allow almost 5 square acres of metal to be painted each hour.

Because paint does not stick well to metal, the cleaning and pretreatment processes are critical. Pretreatment chemically alters the surface of the metal, making it more suitable for primer adhesion.

Popular pretreatments for galvanized steel are traditionally zinc phosphate and, more recently, complex oxides and dried-in-place treatments. Zinc phosphate is thought by most to be more effective as a corrosion inhibitor at cuts, scratches and severe bends, especially in aggressive environments. Pretreatments for Galvalume are chrome and dried-in-place treatments and, for aluminum, chromium chromate. The industry is experimenting with alternatives to some of these pretreatments because of the targeting of phosphates and chrome by environmental activists.

Cleaning, pretreatment and primer applications are the most important to ensure film adhesion and the corrosion protection of the metallic coating at scratches and cut edges.

Primer application follows the pretreatment step. Historically, primers have been epoxy or epoxy-esters. Today, polyester, polyurethane and acrylic water-based primers are being used because they are more flexible and resistant to ultraviolet light. The target thickness of the primer is 0.25 mil and should range from 0.20 to 0.30 mil.

These first steps—cleaning, pretreatment and primer applications—are the most important to ensure film adhesion and the corrosion protection of the metallic coating at scratches and cut edges. Pretreatment makes the primer stick and the primer helps the topcoat stick. After oven curing and cooling of the primer, the topcoat is typically applied at a target thickness of 0.75 mil resulting with total dry-film thickness of both coats of 0.9 to 1.0 mil. This two-coat process is the standard of the commercial claddings industry and by far the most common system used in North America.

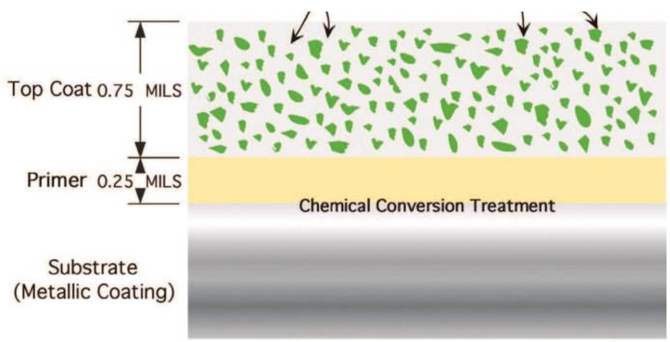
Some newer coating line technologies have also enabled the "printing" of variegated color patterns on metal. Print process incorporates the same types of coatings as standard coil coatings in a three- or four-coat system; however, the coating is applied via a print roll that is engraved with an image, such as a camo pattern, antiqued copper verdigris or wood grain, which is then transferred to the metal coil. Many coating lines will also apply color film laminates using high-performance adhesives.

Paint Resins

Paint is designated by its resin type. Many different coating systems are on the market, and they all offer different performance characteristics at widely varying costs. When we call paint "acrylic, epoxy, fluorocarbon, polyester" or "urethane," we are referring to the resin. Often resins are blended from several different materials.

The resin gives the finish its mechanical characteristics, and some resins are more flexible than others and will tolerate more severe bending during product fabrication. The resin also gives the film its gloss and gloss-retention characteristics, as well as resistance to abrasion, scratching and dirt accumulation. Many of these durability characteristics are the result of hardness, yet hardness also means reduced flexibility and so a delicate balance of the two is requisite.

Typical Two-Coat Paint System



▲Most popular architectural paint finishes are two-coat systems, resulting in a dry film thickness of about 1.0 mil. *Image courtesy of Metal Roof Advisory Group, Ltd., Colorado Springs, CO.*

Polyester resins have enjoyed widespread use due to the broad spectrum of colors available, their applicability to a wide variety of substrates, scratch resistance (hardness) and low cost. There was a time when polyester was considered "low-grade" paint, used primarily for soffit, signage, and industrial or agricultural applications. But polyesters are a broad group of chemical compounds that have diverse characteristics, and many developments within the paint industry have resulted in very resilient, durable polyester resins that can exhibit somewhat higher gloss levels than PVDF when desired.

Some of the newer formulations when blended with ceramic pigments can offer outstanding weathering properties—still not equal to PVDF coatings but much more impressive than thought possible 20 years ago.

Of course, low-grade polyesters are also still out there and when blended with organic pigments will have rather poor performance. Caution should be exercised when making the purchase decision: After a low-cost bright red roof fades to a medium pink in five years, it will be too late to pay the few extra pennies per square foot for a more serviceable product. In addition, severe fading can be non-uniform and very unsightly.

Silicone Polyester and Super Polyesters

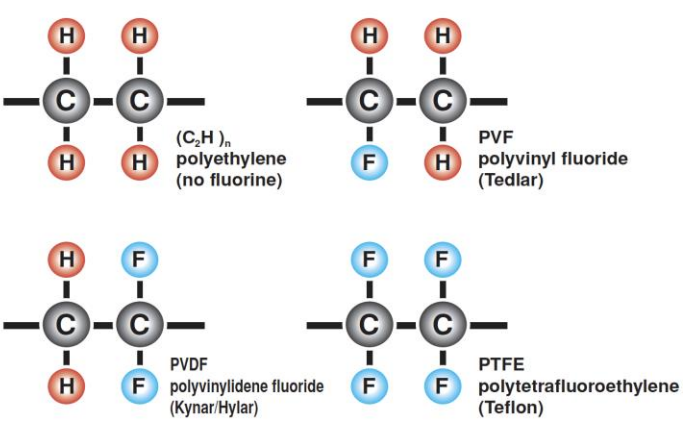
Silicone-modified polyester (SMP) paint systems are a blend of polyester and silicone intermediates. Silicone acts to improve the gloss retention and weather resistance of polyester coatings. As a rule, the higher the silicone content, the better the performance of the paint. Originally, silicone contents ranged from 20 to 50 percent. Due to significant advances in polyester chemistry, however, these percentages are less of a controlling factor, and 50 percent SMP (once a premium resin) has not been marketed for many years. New chemistries outside the typical silicone modifications are also emerging that have very good weathering characteristics when compared with straight polyester. These new resins involve proprietary formulations and have been called “super polyesters.”

For the contractor, the cost of an SMP or super polyester finish is in the range of 15 or 20 cents per square foot (a bit less for white). These formulations are available in a variety of gloss levels and will retain the gloss longer than polyesters. Some formulations come with up to 40-year warranties but don’t be fooled. These warranties will typically specify lower performance levels than PVDF coatings.

PVDF

Fluoropolymers, known chemically as polyvinylidene fluoride or polyvinyl di-fluoride (PVDF or PVF_2) are the current state-of-the-art coatings. Dupont first began exploring the carbon-fluorine bond about 1948. PVDF resin was first developed and manufactured in 1962 and produced and process-patented by Pennsalt Chemicals (later Pennwalt Corp.). Beginning in 1965, it was marketed under the name Kynar® or Kynar 500®.

Molecular Structure of Fluoropolymer



▲ This shows the molecular structure of fluoropolymer coatings, their respective trade names and a comparison to a polyethylene molecule. These polymers have similar properties derived from their atomic structure and fluorine bonds. *Image courtesy of Metal Roof Advisory Group, Ltd.*

Elf Aquitaine subsequently bought Pennwalt, but in the process, the U.S. Federal Trade Commission required a breakup of this production and technology. At that time Ausimont USA Inc. purchased production rights in Thorofare, N.J., (one of two production facilities) and subsequently introduced Hylar 5000® to compete with Kynar 500. Kynar 500 is now produced and marketed by ATOFINA Chemicals Inc. (formerly Elf Atochem).

For practical purposes, the two products are in a generic sense alike. The key to Kynar/Hylar performance can be found in its basic chemical foundation: The carbon/fluorine bond is one of the strongest chemical bonds known. The resin’s chemical formulation (PVDF) makes it similar in some respects to Teflon (PTFE), the popular nonstick coating for pots and pans. It is a slippery finish that enables most environmental pollutants to wash off in the rain. This is also why adhesives do not stick well to it. Paint using this resin is usually offered in a medium- or low-gloss finish with excellent weathering and color-stability characteristics. When formulated with the "full-strength" 70 percent PVDF resin content, these coatings are offered with 25-year or longer warranties featuring high levels of protection.

The two companies that produce these resins sell the resin powder (under license) to various paint companies who pin their own trade names on the resulting products. Twenty years ago there were six; today only three:

- Trinar® (Akzo Nobel)
- Duranar® (PPG Industries)
- Fluropon® (Valspar Corp.)

To confuse matters further, the paint is sold to panel manufacturers and coil suppliers who pin their own trade names on products utilizing that paint type, for instance:

- Butler-Cote® FP 500 (Butler)
- PAC-CLAD® (Petersen Aluminum)
- Signature® 300 (MBCI)
- UnaClad™ (Firestone, formerly Copper Sales)

Contractors and designers can find this profusion of trade names very confusing when reviewing specifications.

Simply specifying Kynar/Hylar, fluorocarbon or PVDF will not ensure paint containing the "full strength" 70 percent formulation, but specifying "Kynar 500" or "Hylar 5000" will. The number designation ensures (by licensing arrangements) that paint containing 70 percent PVDF resin is provided. The remaining 30 percent of the resin is a proprietary acrylic, which varies from one supplier to the next.

PVDF is a thermoplastic. The powder particles are expanded by heat during the curing process, becoming plastic and forming a homogeneous film.

Standard PVDF is typically not available in bright, high-gloss colors because of the matte nature of the resin, and the natural colors of the ceramic pigments. However, it is still widely used in architectural applications and is more expensive for the contractor than SMP, usually 10 or 15 cents more per square foot.

Various PVDF systems are available, including two-, three-, and even four-coat types with varying dry film thicknesses. For specification purposes, two-coat PVDF is the industry standard. Over the years we have seen a direct relationship between coating performance and the 1-mil dry coating thickness of standard (two-coat) systems. A coating applied under spec will not perform as well as the 1-mil finish.

These facts are pertinent because of the higher relative cost of these films. Reduce the film thickness and the cost to the producer is significantly reduced. But at what cost to the material's performance? End users and specifiers should check film-thickness integrity to be sure they get what they pay for. More topcoat than 0.75 mil is also not necessarily better, although most agree that in a salt environment thicker prime coats can improve performance.

Specification References: The Short Version

Chalk
ASTM D-659 (Rating scale of 1-10; 10 is best)

Fade
ASTM D-2244 (NBS or ΔE Hunter units; 0 is no change)

Weathering
These specifications include many standards as measured by ASTM procedures enumerated in the chart titled "Specification References: The Rest of the Story." Acceptable levels of performance are inherently included.

AAMA 603.8, "Pigmented Organic Coatings" (conventional paints)
AAMA 605.2 (92), "High-Performance Organic Coatings" (premium finishes, includes minimums for chalk and fade)

Metallic Finishes

Much of the research and development in PVDF coatings has centered around the production of metallic finishes, such as Duranar XL (PPG), Fluropon Classic II (Valspar), and Tri-Escent II (Akzo Nobel). These finishes have a high-tech look with a deep luster and depth of color and the sheen and reflectivity of a natural metal.

Traditionally metallics have been expensive because they consist of one and sometimes two extra coats. These finishes typically include a primer, a paint coat containing metal flakes (usually aluminum), and a clear PVDF topcoat that protects against ultraviolet light and oxidation of the metal flakes suspended in the coating. As you might expect, the extra topcoat required for this type of finish adds significantly to the cost. On most paint lines, the metal must run through the line twice, increasing handling expenses.

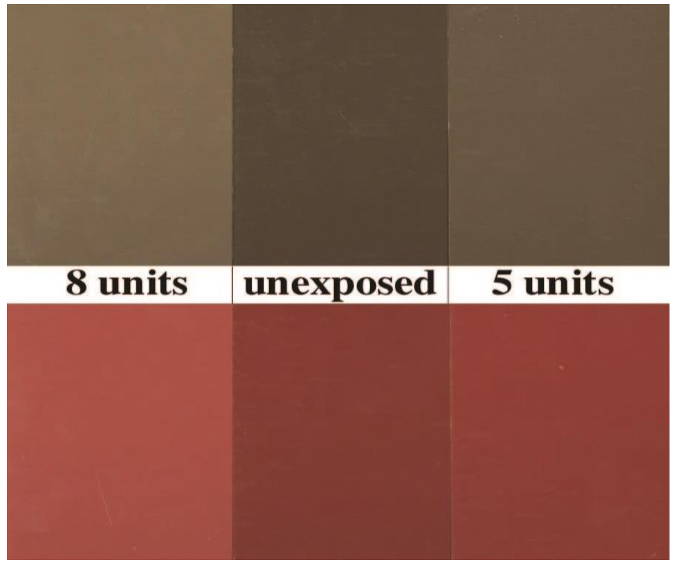
By substituting powdered mica to the paint-blending process, manufacturers can now offer two-coat formulations that cost less to produce and exhibit greatly improved batch-to-batch and panel-to-panel color consistency. Mica lends the reflective sheen desirous in a metallic coating without the reflectivity and weathering concerns inherent in metal flake. The result is "metallic" coating that does not possess the finicky characteristics or high costs of three- and four-coat metallic systems. And there is only a slight trade-off in depth of color and sheen.

Very recent technologies also involve paint films that reflect different pigment layers when the angle of view changes. This produces an illusion that the paint is actually changing color as you walk or drive by. (How cool is that?) It is done by using two pigment layers and chips that reflect one layer or the other, depending upon the optical angle.

Take care when using any of these products as the finishes are all directional. The appearance will be conspicuously different when viewed from opposite directions. If a piece of flashing is

▲ Real-world exposure testing is the only infallible way to prove paint performance over time. South Florida is the favored test geography because of high heat, ultraviolet and moisture conditions. *Photo courtesy of Atlas Weathering Services Group, Miami, FL.*

inadvertently end-for-ended, it will be quite visually distracting. For this reason, the coater will often



▲ Color change (fade) is measured in NBS Units or ΔE Hunter Units. One unit is the smallest degree of fade detectable to a trained eye. Premium paint warranties usually limit fade to 5 units. *Image courtesy of Metal Roof Advisory Group, Ltd.*

code the product with directional arrows on the backside.

Pigments: Organic vs. Inorganic

Pigment—the powder that gives color and hiding ability to the finish—is organic or inorganic in composition. Sometimes both types must be used to achieve a certain shade or color. Inorganics, which are manufactured from complex metal oxides, have superior color stability and chemical resistance. They are the same ceramic pigments that have been used in the firing of porcelain for hundreds of years.

Metal oxides vary widely in cost; while they are all considered premium products, the stability of these pigments is not necessarily the same from one oxide to the next. In addition, they aren’t available in all colors, including bright reds and yellows, so in those cases there is no alternative but to use less stable organic materials. On the flip side, white is only available as an inorganic (titanium-dioxide) pigment; there is no organic alternative.

In general, paint manufacturers will blend ceramic pigments with premium resins and organic pigments with less-expensive resins, but there is no industry mandate to do this. Perhaps there should be as cost incentives to use inferior pigments can be significant. The higher-cost inorganics include blue, green and black. Because black is a component of almost every applied color, there is profit to be gained (but performance lost) by using the less-stable carbon black compound. By strict definition carbon black is organic, but it is a raw element so it is often deemed inorganic.

Although PVDF finishes from all producers consistently use the higher-grade ceramic pigments, the same cannot be said of mid- and high-grade alternative resins. Hence polyester and siliconized polyester and other resin blends may exhibit wide variations in color stability from one supplier to the next. In some cases, a producer may use a ceramic pigment in one paint color and an organic pigment in another— yet label the paint with the same trademark. Or the product may have a high organic content with just a smidgeon of ceramic and be advertised as containing ceramic pigment.

In general, the "cleaner," or purer, the color, the more rapidly and drastically the pigment will fade. Bright red is one of the worst. When possible, select colors having muted tones. For instance, if the customer wants red, suggest a brick red rather than a fire-engine red. A darker shade will not necessarily fade more than a lighter one, as long as the color is not pure and it uses good-quality inorganic pigments.

Measuring and Testing Paint Performance

The primary exposure conditions that degrade paint over time are sunlight, heat and moisture.

Don't be fooled into thinking that 70 percent PVDF from company "A" will outperform the same material from company "B" just because the warranty offered is longer term.

Specification References: The Rest of the Story

Most of these ASTM procedures are not pass-fail but quantitative in nature, hence the specifier must know and state the level of performance desired and include the same as part of a performance specification.

Performance Aspect	ASTM Procedure
Film Thickness	D-1005
Specular Gloss	D-523
IR Reflectivity	D-3363
Flexibility	D-4145
Adhesion	D-3359
Reverse Impact	D-2794
Abrasion, Falling Sand	D-968
Mortar Resistance	C-267
Detergent Resistance	D-2248
Acid Pollutants	D-1308
Salt-spray Resistance	B-117
Humidity Resistance	D-2247
South Florida Color Change	D-2244
Chalk Resistance	D-4214
QUVB	G-53
Acid Rain	(Kesternich)

Certain airborne chemical pollutants and acid rain can also accelerate degradation. Because all paints are affected by this degradation, the only quantification is how badly and how quickly it takes place, hence warranty language will always reflect units of measurement over time.

The components of paint vary in quality, performance and cost. If properly applied, the paint system should last well over 30 years in terms of adhesion (resistance to cracking, blistering and peeling). Consequently, when we ask "How long will the finish last?", we are really asking "How long will it retain its true color and gloss?" The answer depends on two factors: pigment stability and resin type/quality.

Ultraviolet light chemically breaks down the components of the finish, resulting in chalk and fade. Moisture and heat exacerbate this chemical breakdown. Chalk, or the appearance of a whitish, powdery substance on the panel surface, is the result of a breakdown of carbon bonds in the finish. It is rated on a scale of 10 to 1, with 10 being no measurable degradation. A chalk rating of 9 is not noticeable while a rating of 7 is quite conspicuous.

Paint performance is not linear with time, so interpolation from short-term testing is not reliable in predicting long-term performance.

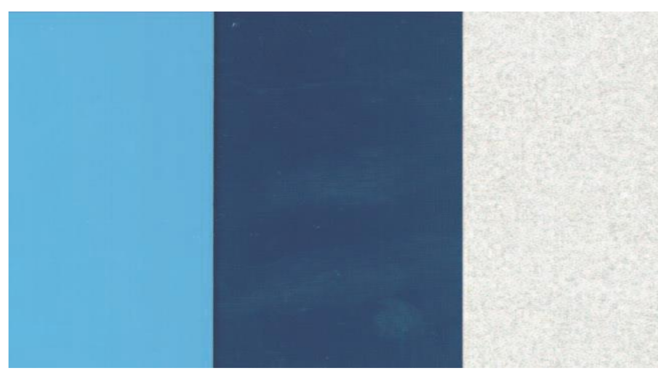
Fade (color change) is caused by loss of gloss and the gradual breakdown of the pigment. It is measured in N.B.S. (National Bureau of Standards) or ΔE Hunter units (referring to the Hunter Colorimeter used to measure color variation). A lower ΔE rating denotes higher performance. One unit is the smallest degree of color change perceivable by the naked eye. A change of 4 or 5 units is detectable to any observer but generally not objectionable, provided that the fade is uniform. Fade, of course, is the most common type of color change with the color gradually "bleaching" toward white. But color change can also occur laterally. Green, for instance, may become more yellowish or bluish with time.

The rate of fade and chalk will be different, depending on the surface's orientation to the sun. The consistency of fade is as important as the rate, but the industry has not established a unilaterally accepted standard for this aspect of paint performance. It may be assumed, however, that considerable risk is associated with a "bargain-basement" finish containing poorly performing resins and pigments. The resulting "checkerboard" effect of inconsistent fade can be as bad or worse than accelerated color change. The loss of gloss, or the pick up of dirt, can also pose visual distractions that contribute to color change but are outside the realm of color change as normally measured by the industry.

The most reliable test of paint performance is exposure to real weathering conditions over time. Because of the degrading effects of heat, sunlight and moisture, the favored spot on the map for testing paint performance is South Florida. Driving around this area of the country, you may see one of many "farms" with row after row of fences containing tens of thousands of metal chips mounted at optimal angle to the south sun. Paint manufacturers use these chips to field test new products and formulations, and they closely monitor their performance by measuring chalk and fade characteristics year after year.

An industry that is dynamic and inventive is always impatient to evaluate new technology. Mother nature takes time, and time is money—big money. Waiting to market a new paint technology until it has been exposed for 20 (plus) years is not often done. But paint performance is not linear with time, so interpolation from short-term testing is not reliable in predicting long-term performance. Because we achieve 2 units of fade in five years does not mean we can expect 4 units in ten. Therefore, the industry sometimes relies on accelerated test methods to evaluate new technology.

One method sometimes used to accelerate weathering artificially is the QUV chamber, which applies intense artificial light (using one of two different ultraviolet bulb types) with heat and moisture. A testing facility outside of Phoenix, called EMMAQUA (Equatorial Mount with Mirrors for Acceleration with Water), is a better method of accelerating weathering because it magnifies the natural effects of the sun by using mirrors and sun tracking in an outdoor environment along with induced moisture. However, both of these accelerated test methods have been shown to be inaccurate in some cases when compared with the



▲ A Megaflon (100 percent FEVE) blue, 70 percent PVDF blue and 70 percent PVDF silver metallic finish. *Image courtesy of PPG Industries, Pittsburgh, PA.*

real-world exposure tests over real time.

What Do Warranties Cover?

It is appropriate when discussing paint performance to include some commentary regarding industry performance warranties. Unfortunately, it appears the warranty wars in paint finishes have begun. A 20-year warranty used to be the industry standard for PVDF finishes, and all producers offered essentially the same warranty. Claims were rare, and the performance coverage was oriented to the worst-case scenario: a 45-degree south-facing medium-blue surface exposed to South Florida sun and humidity.

Whereas in the past, the warranty might have been a conservative indicator of expectable paint performance, this is not necessarily true today. We are now seeing 25, 30 and even 35-year PVDF warranties, yet the finish chemistry and technology has changed little—if at all.

While it is true that paint films will perform much better in most climates and environments than they do on maximum-exposure test sites, some of these claims just go too far—with the warrantor perhaps banking on the warranty documents being misplaced and forgotten over time. The fact that a longer warranty is offered is not always evidence that the product is superior. Expected performance and conservative warranty coverage for a PVDF finish is as follows:

- Color Change: 5 or fewer ΔE Hunter units over 25 years
- Chalking: A rating of 7 or higher over 25 years

In both cases, expected performance depends on the environment and orientation of the surface to the sun.

Warranties will normally cover film adhesion

Prints and laminates enable "faux" patterns featuring multiple colors. Clockwise from above: A camouflage print from McElroy Metals; copper vertigris and wood grain prints from Coated Metal Goods; and a stacked stone laminate also from McElroy on which the ribs of the "M-Corr" panel are barely discernible. Prints are typically three- or four-coat systems. Most are premium cost finishes because of the additional coats of film. Laminates are separate (cured) films applied at the coil line or a separate line using high-performance adhesives. *Images courtesy of McElroy Metals and Coated Metal Goods.*

and maximum levels of chalk and fade within the warranty period. Nowadays many warranties cover chalk and fade for 25 years and film adhesion for 40 but are advertised as "40-Year Warranty." Because color is the real function of paint, buyers should beware and scrutinize warranty language and coverage carefully. Vertical surfaces will perform better than horizontal ones, and warranty language may also reflect this.

Warranties exclude certain conditions, such as under-film corrosion. This point bears emphasis: There is a common misconception that if the metal corrodes, it is a covered failure under the paint warranty. This is not true! These thin paint films are permeable, absorbing and releasing moisture cyclically with exposure and temperature change. If that moisture is chemically aggressive, it is possible for the metal to corrode from beneath the paint film, especially at cut edges and scratches. Such a failure is not covered by paint warranties. Therefore, the integrity of the substrate (metallic coating) and its corrosion performance are still of vital concern for prepainted steel panels.

Be sure to scrutinize warranted performance criteria when selecting products. In particular, look for acceptable levels of chalk and fade in terms of NBS or Hunter units. We have seen long-term warranties cleverly written using units that permit your red roof to turn pink and be covered with white powder well within the warranty period and limitations. Read all the fine print and be sure to keep track of the warranty documents for the full term of the warranty.

Don't be fooled into thinking that 70 percent PVDF from company "A" will outperform the same material from company "B" just because the warranty offered is longer term. Likewise, don't think that SMP performance will equal PVDF just because warranty language is similar. Put more faith in time-proven products than in warranties.

ASTM spec references are listed on pages **5 and 7**. Additionally, when ordering premium paint systems, reference is suggested to meeting all "Premium Painted Requirements" as set forth in the Glenview, Ill.-based Metal Construction Association Metal Roofing Certification Program.

Innovation Continues

The paint finish industry is a dynamic one, and the technology is continually improving. For example, clear coats are now available that give depth and sheen to coatings that were once only available in lower-gloss finishes. Recent innovations in resin technology have included the development of thermoset coatings, such as Megaflon®, which uses a 100 percent FEVE (fluorinated ethylene vinyl ether) resin called Lumiflon®.

This and other recent resin technologies have broadened the color spectrum and gloss levels of fluoropolymer coatings to include bright plastic-like colors that previously would have been available only in polyester formulations. Also in the works are new-generation polyesters that may approach the performance levels of PVDF finishes.

All these paint systems have their place. Even low-cost alternatives can be used successfully in soffit applications or as architectural accents to shopping mall interiors and other non-critical applications where use of 70 percent PVDF may be considered over-specification. On the other side of the coin, using a bargain-basement paint system in an exposed architectural application for the sake of saving 15 cents a foot is a disastrous error, shackling the end user to costly field painting every few years or total replacement with the material that should have been used originally. Often, this is a mistake resulting from specifier and/or contractor ignorance or haste or a less-than-honest vendor chain.

There are also other resins that have their place. Plastisol is sometimes used in very aggressive environments. Unlike most resins, this vinyl plastic is less permeable because it is used in "thick film" applications of 4 mils or more, thus providing "barrier" corrosion protection and pigmentation. Be careful of vivid colors when using this material because its color change characteristic is often somewhat inferior.

Another recent trend is a result of the focus on "cool roof" issues and involves the use of solar reflective pigments (SRP). These pigments are chemically or physically altered to reflect the infrared spectrum of light, reducing solar absorption, increasing reflectance and hence reducing the temperature of the panel. Although this spectrum of light is what heats the surface of an object, infrared light is invisible; therefore, the eye perceives no difference in color of the panel. Use of these pigments can meet Energy Star criteria for reflectance of 0.65 or greater even for dark, rich colors. When aged reflectance testing is conducted, PVDF coatings with SRP emerge as the undisputed winners as competing roof materials fade and collect dirt and algae growth, reducing reflectance during a few years' time whereas the PVDF does not.

Field Painting and Touch-up

In this age, any new construction design requirement asking for field painting or other air-dried painting of coated sheet steel and aluminum product is obsolete and a customer disservice. Field-applied and other air-dried paints will generally disappoint, not only from a quality standpoint, but also from an economic one. Field painting is three or four times more expensive than coil coating.

Although color-matching is made easy by computer technology, the match of air-dried paint is temporary, and the rates of fade are much different; after several years, the detriment to aesthetics can be quite alarming. Remember this when using touch-up paint and when using painted rooftop accessories. In the field, substrate preparation is highly critical to paint adhesion and very difficult to control.

Film thickness in field applications is also at the mercy of the applicator. In the end, even the highest quality preparation and application methods cannot be expected to render the kind of service life of factory-applied premium finishes.

Prepainted coil or flat sheet is quite available for related flashings and guttering and should be used in tandem with pre-painted roofing sheet. When use of mill steel shapes in exposed application is unavoidable, the appropriate solution is a prefinished sheet metal shroud as opposed to attempts to matching field-applied paints, which inherently pose a continual maintenance problem.

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Founded in 1983, the Metal Construction Association brings together the diverse metal construction industry for the purpose of expanding the use of all metals used in construction. MCA promotes the benefits of metal in construction through:

- Technical guidance
- Product certification
- Educational and awareness programs
- Advocating for the interests of our industry
- Recognition of industry-achievement awards
- Monitoring of industry issues, such as codes and standards
- Research to develop improved metal construction products
- Promotional and marketing support for the metal construction industry
- Publications to promote use of metal wall and roof products in construction

For more information, please visit the MCA Web site at www.metalconstruction.org.

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