

## Coatings for today's roof systems

These days coatings serve useful roles in the maintenance of all types of roofing substrates. They can be used to extend the service life of an existing system in nearly any environment, and in warmer climates they can offer significant energy savings.



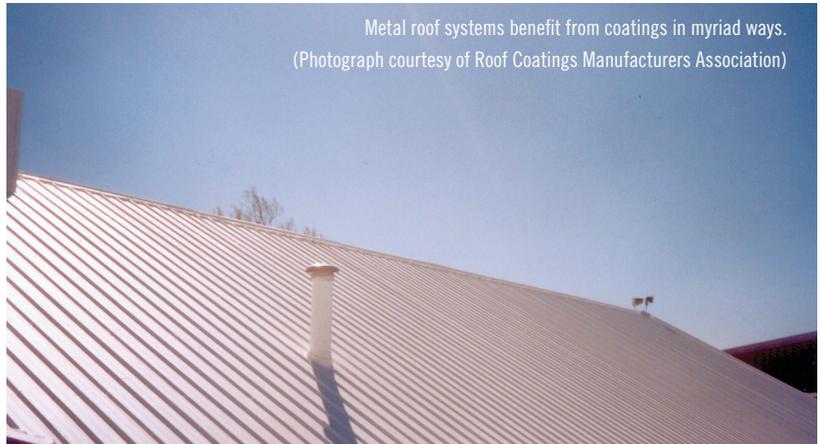
By Steve G. Heinje  
Guest Columnist

Asphalt coatings have long played a role in extending the life cycle of black roofs by providing a renewable weather barrier over the field of the roof while offering additional protection at transitions and flashings. They form a seamless first line of defense against the environment, and provide an immeasurable service to the roof by helping to shed water.

In the 1970s spray polyurethane foam (SPF) roofing emerged as a monolithic, lightweight alternative to conventional construction, with the coating serving as a breathable weather barrier over an extremely efficient layer of insulation. SPF roofs generally utilize breathable coatings based on silicone, urethane or acrylic chemistry, and they helped introduce “high-end polymers” to the roofing industry.

The trend toward lower-thickness (but higher-performance) membranes

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Metal roof systems benefit from coatings in myriad ways.  
(Photograph courtesy of Roof Coatings Manufacturers Association)

### JUNE CALENDAR ITEM coatings



Baumann



Grace



Meyer



Salazar

Four industry experts — Kate Baumann, marketing director, Mule-Hide Products Co. Inc.; Jeff Grace, product services manager, United Coatings; Tom Meyer, technical manager, Technical Roof Solutions (Roof-Tek); and Chris Salazar, vice president of sales and marketing, Karnak Corp. — discuss the state of metal roof coatings:

#### Why are coatings applied to metal roofs?

**Baumann:** Metal roofing systems with original factory-applied coatings will experience coatings degradation due to weathering and are re-coated with an appropriate maintenance coating to restore and extend the life of the roof. Uncoated metal roofing systems experience galvanic corrosion and are also candidates for roof lifecycle extension by being coated with a corrosion-inhibiting coating system. White reflective coatings have the added benefit of a “cool roof” for energy savings.

**Crace:** When applied to metal roofing, coatings can perform several important functions, ranging from aesthetic to weatherproofing. They offer a choice of color, protection against moisture intrusion, potential energy savings, and structural enhancement, all at a reasonable cost. And they provide a sustainable, long-term option to the eventual replacement of leaky, corroded metal panels that may be covering expensive buildings and their contents.

**Meyer:** Also, metal thermally expands and contracts. This movement can cause the screw holes to elongate. A coating system can be used to address this problem for retrofit and repair. Metal roofs typically have a good coating when new, but this original coating can wear out over time, exposing the roof to rusting.

**Salazar:** Coatings can prevent deterioration by providing a “sacrificial” layer to take the

punishment that the elements and the environment dole out. Depending on the geographical location and building configuration, coatings can reduce energy consumption and improve building occupant comfort. Reducing hot building temperatures has been shown to improve productivity; and studies have shown that cooler building temperatures improve the weight of livestock and reduce water consumption. Coatings can waterproof a leaky roof. Roof coatings also protect the integrity of a metal roof by reducing thermal-shock roof damage. A cool roof coating moderates the excessive thermal expansion and contraction that otherwise could lead to fastener and seal failures.

#### What factors are influencing current demand for metal roof coatings?

**Baumann:** Energy shortages are driving the need for energy savings, and the building industry is also experiencing a greater sensitivity to environmental concerns. These two issues are influencing demand for field-applied roof coatings that deliver cool roofs for energy savings as well as sustainability. Three industry programs are leading this trend – Leadership in Energy and Environmental Design (LEED) green building rating system, Energy Star, and California Title 24.

**Crace:** Most recently, the trend toward “cool roofing” has favored the selection of highly reflective (resistant to absorption of solar energy) and emissive (capable of releasing absorbed energy) coatings for use over metal.

Architects, engineers, and owners have become aware of their value in reducing air conditioning requirements while providing a highly effective front line of defense against the elements.

**Meyer:** Demand is up, because metal roofs typically last 10 years to 15 years before issues develop. Metal roofing is typically factory coated, so most aftermarket metal roof coatings are applied for roof repair. Many of the metal roofs applied in the 1990s are now in need of repair. Older families of metal roofs typically have more need of repair and can benefit from metal roof coatings. Demand for metal coatings is also being driven by their cost effectiveness and greater interest in reflectivity.

**Salazar:** There are a variety of coatings in the marketplace for metal roofs. Which one is best for any application depends on the desired performance, budget, and code requirements. Metal roof coatings include acrylic, aluminum coatings, rubberized aluminum, SBS or SEBS white coatings, polyurethane coatings, soy-based polymer roof coatings, and other polymer-based roof coatings

#### What new coatings are specifically designed for metal roofs?

**Baumann:** The latest coatings designed for metal roofs are zinc-rich metal roof primers that improve adhesion of finish coatings while encapsulating rust and inhibiting the development of new rust.

## metal roofing

**Crace:** Although newer polyurea and fluoropolymer formulations have generated a great deal of interest, traditional acrylic and polyurethane products continue to offer time-tested performance characteristics as well. Regardless of the product chosen, it must possess a proven balance of strength, elasticity, and weatherability to withstand the rigors of the environment to which it will be exposed.

**Meyer:** Polyurea is a relatively new two-component coating technology that is well suited to metal roofing. It also has good elongation and a high tensile strength, i.e., about 1,500 pounds per square inch (psi) compared to 200 psi to 400 psi for other coatings. Polyurea also results in a harder surface than other types of coatings, so rain will wash dirt off the hard surface relatively easily; it is easy to keep clean. Another new technology is based on fluoropolymer coatings, such as Kynar, which promise high reflectivity, durability, and excellent cleanability.

**Salazar:** Building Code changes are requiring the use of cool roofs. Energy efficiency initiatives are promoting the use of cool roofs, which may lead to substantial energy savings. The green building movement is raising awareness of the benefits of reflective roof coatings. More generally, environmental awareness of global warming is also raising interest in cool roofs. With regard to specific applications, the cost effectiveness, proven performance, ease of application, and sustainability of metal roof coatings are important factors driving demand.

### What metal roof applications are good candidates for roof coatings, and what types of coating are typically applied to them?

**Baumann:** Both factory-applied coated metal roofing systems and uncoated metal roofing systems are ideal candidates for roof coating restoration, including steel, aluminum, and galvanized metal systems. An adhesion test is recommended prior to coating. Some factory-applied metal finishes, such as Kynar-500 and some coatings such as silicone, are surfaces to which acrylic products may not adhere well, and a different solution may be more appropriate. While acrylic coatings are growing in popularity due to their environmentally friendly attributes, polyurethane, silicone, and polyurea are used for certain applications. Typically four products are used in a metal roof coating system — a cleaner, a metal roof primer, a flashing grade sealant, and a finish coating.

**Crace:** All metal roofing must be clean and sound before coating. Assuming no structural problems exist, virtually any type of aged metal (galvanized, enameled, aluminum, etc.) will benefit from the application of a seamless coating membrane. Appropriate surface cleaners, conditioners, and primers are available to ensure a good match of coating with substrate.

**Meyer:** Any metal roof on a commercial or residential building is a candidate for a metal roof coating. A lot of cool roofing today is being done

with foam over metal. The foam layer acts as a buffer layer to absorb the expansion and contraction. Reflective coatings are then applied on the foam.

**Salazar:** Most metal roofs are good candidates for roof coatings. The coating type may vary depending on the building owner's preference and the performance, budget, and code requirements specific to the building.

### What is your preferred method for applying coatings to metal roofs?

**Baumann:** Typically four steps are needed to properly coat a metal roof. First, all loose coatings, heavy rust, debris, and fresh roof cement must be removed, and the existing roof system must be repaired — such as replacing missing or loose fasteners and metal panels as needed. Then the roof is power-washed at 2000 psi with a cleaner, using an airless spray rig. Step two is to prime the roof with a metal roof primer using an airless spray gun followed by a wet film gauge to determine the proper mil thickness has been applied. Step three involves flashing fasteners, penetrations, seams, and lap joints with a flashing grade sealant that can be brushed, rolled or extruded. The final step is to apply the finish coating, using the airless spray gun, followed by the wet film gauge to ensure proper mil thickness. A typical dry mil thickness for the finish coating is 18 to 25 dry mils, achieved in two to three coats. The finished coating system serves as the top layer of the roofing system. This is quite different from a paint film thickness of approximately three dry mils.

**Crace:** Seams, penetrations, and fasteners are typically treated manually, using a combination of coating, caulking, and reinforcement. Application of the roof coating is then generally accomplished by spray, due to efficiency and uniformity issues. Single-package and longer potlife products may be applied by brush, roller, or a combination of spraying and backrolling but usually only on projects of limited size, or where special considerations or limitations restrict the installation method.

**Meyer:** Spray applications methods are best for metal roofs because of the irregular shapes and joints that must be covered.

**Salazar:** Coatings can be applied using brushes, rollers, or spray rigs. I prefer spray because it is much more uniform. Seams should always be done by hand.

### What is the relationship between coating color and roof temperature?

**Baumann:** White coatings offer the highest reflectivity and emissivity, but other “cool colors” have been introduced that are listed by the Cool Roof Rating Council (CRRRC). Reflectivity is the amount of solar energy a roofing material's surface reflects. Emissivity is the amount of absorbed energy a roofing material radiates from itself because of the material's own heat and temperature. A top quality roof coating both reflects infrared and UV of the sun and emits absorbed heat. A white or light “cool roof” reduces air-conditioning costs and stress on the roofing system and can extend the life of the roof.

**Crace:** Generally, lighter colors exhibit higher reflectivity, which translates to less energy absorbed and a lower surface temperature. However, the composition of a coating can affect its emissivity, which directly impacts the amount of heat retained in the roof. And new generation pigments, designed to resist wavelengths outside the visible spectrum, allow for cool roofing in colors other than stark white.

**Salazar:** Historically the lighter the roof is, the cooler the roof surface. The

recent introduction of “cool color” coatings, however, has blurred the line with respect to the differences between the various colors. The best source to use to compare is the CRRC ratings for the coatings. The ratings list reflectivity and emissivity. These two attributes can impact energy savings significantly, but how they work varies by geography. Stay tuned for guidelines by the U.S. EPA Energy Star Program on the use of these attributes.

**Q** Is dirt pick-up a problem with white, reflective roofs, and how often do they need to be re-coated?

**Baumann:** Roofs collect dirt, and a white, reflective roof will lose some solar reflectance over time. Field studies by Lawrence Berkeley National Lab in Berkeley, Calif., have shown that reflectivity may drop to about 80 percent of the original value. Aged reflectivity might drop from 80 percent to 85 percent down to 60 percent to 65 percent, depending on the climate and the air quality at the roof's location. This is still much cooler than a dark roof with 5 percent to 35 percent reflectivity. Proactive maintenance by building owners and facility managers can keep a roof surface clean and restore reflectivity. Roof coating manufacturers typically offer five- and 10-year warranted systems for metal roofs. All metal roofing must be clean and sound before coating. Assuming no structural problems exist, virtually any type of aged metal (galvanized, enameled, aluminum, etc.) will benefit from the application of a seamless coating membrane. Appropriate surface cleaners, conditioners, and primers are available to ensure a good match of coating with substrate.

**Crace:** A well-designed coating, regardless of color, should be resistant to dirt pickup and be reasonably receptive to cleaning when fully cured. Yet the very properties that allow the membrane to remain pliable through cyclic temperature and climatic changes can undermine this, particularly with lighter colors and in low-slope situations. This is best remedied by initiating a semi-annual maintenance program that includes a thorough cleaning, inspection, and repairs.

**Salazar:** Dirt pick-up is a problem with any white roof surface no matter its make up. Obviously the less sticky a roof surface is the less likely it will hold on to dirt that is deposited on its surface. However, there can be a trade off between tackiness (sticky roof surfaces) and hard, glossy surfaces that track little dirt. The latter may not have good impact resistance or the ability to resist excessive movement or temperature swings. Building owners should consult manufacturers for recommendations based on the building characteristics and location.

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was mirrored in other waterproofing materials as well. Lighter-weight roof products, including modified bitumen, ethylene propylene diene terpolymer (EPDM), Hypalon,

Coating Technologies	
Resin/polymer	Leading Formats
Asphalt	Solvent-cut and emulsified
Acrylic	Emulsion
Silicone	Solvent-cut
Polyurethane	Solvent-cut and 100 percent solids
Hypalon	Solvent-cut
Butyl	Solvent-cut

polyvinyl chloride (PVC), and thermoplastic polyolefin (TPO), all benefit from maintenance coatings in extending their service lives, aesthetics, and cool roof qualities.

The Roof Coatings Manufacturers Association (RCMA) membership includes leaders from every important segment of the coatings market capable of assisting the contractor and building owner in making the most of their roofing assets. The array of available substrates and coatings has grown nearly threefold over the past 20 years.

Products are better and can do more, but as the options have increased, the choices have become more complicated.

There are water-based, conventional, and 100 percent solids coatings, and primers with special formulations for asphalt, PVC, EPDM, TPO and metal roofs. Volatile organic compound (VOC) regulations have severely limited the use of solvent-based

products, and by the end of 2007 it is anticipated that most of the United States and Canada will enforce restrictions as stringent as California's landmark 1996 rules. This has led to a greater acceptance of acrylic products and, more recently, 100 percent solids American Society for Testing and Materials (ASTM) Type V polyurethanes and polyureas.

In terms of water-based technology, asphalt emulsions,

in black or aluminized, are the workhorses of the industry. However, since the 1990s, white, reflective acrylic coatings have become increasingly important in this arena.

Many specialized resins are available for roofing applications. The two most important are acrylics that meet the requirements of ASTM D 6083 and those made specifically for blocking asphalt bleed-through. A high-performance alternative is the polyurethane family; formulations include the exceptionally UV-stable aliphatic grades or less expensive aromatic types that are prone to yellowing and aging.

Increasingly, these are available in 100 percent solids, two-component (ASTM Type V) formats to avoid the limitations that come with using solvent. Polyurethanes can be breathable (as are acrylics), or vapor retarders (as are asphalt cutback coatings). Manufacturers often combine these different types of coatings into a system, such as an acrylic over asphalt emulsion.

Table 2 is a summary of suggested roof substrate and coating combinations. Please note that this table cannot possibly cover all the technical approaches available, nor does it provide details such as primers and flashing grades. What it does illustrate is the range of solutions available to the contractor or building owner to prevent problems and save money on almost any roof.

table 2

Substrates		Typical Applications		Common Alternatives
Membrane	Objective	Primer/Details	Top Coat	
BUR	Extended service life and cool roofing	Asphalt emulsion	Aluminized top coat	Acrylic
Mod-Bit	Repair Extended service life and cool roofing	Acrylic (specifically for asphalt)	Acrylic	Asphalt emulsion and aluminized topcoat
SPF	Critical system component and cool roofing	D-6083 Acrylic	D-6083 Acrylic	Polyurethane or silicone
Metal	Leak repair and cool roofing	Details with butyl tape	D-6083 Acrylic	Details with urethane
Hypalon	Extended service life	D-6083 acrylic	D-6083 Acrylic	Moisture-cure urethane
EPDM	Extended service life and cool roofing	Primer/cleaner for EPDM	D-6083 Acrylic	Solvent-based SEBS asphalt
PVC	Extended service life	Optional: primer for PVC	D-6083 Acrylic	
TPO	Extended service life	Primer specifically for TPO	D-6083 Acrylic	

Author Steve Heinje is the co-chair of the RCMA White Coatings Council and a member of the RCMA Board of Directors. RCMA is the leading national trade association representing the manufacturers of cold-applied roof coatings, cements, and waterproofing agents, and the suppliers of materials, services, and equipment to the industry. Contact RCMA at (202) 207-0919.