A Case for Cool Roofing

Understanding its properties and benefits is best defense when talking to building owners

White coatings offer big benefits. As legislators and architects embrace the idea that building design has a huge impact on energy consumption and sustainability, white coatings remain in the spotlight. However, building owners don't often appreciate their immediate benefits. Convincing them of their value is challenging, but the best way to make your case is by combining two indisputable arguments.

White Coatings Extend a Roof's Life Cycle

•White coatings protect membranes with a chemical barrier and reflect sunlight, both of which increase the longevity of a roof.

White Coatings Save Energy

•The reflection of solar radiation contributes significantly to lowering the cost of air-conditioning.

We Have the Power . . .

Solar energy impinges the earth in astronomical amounts that far exceed the energy man can generate. The vast power of the sun is best appreciated with respect to how its energy would compare to our own energy usage. According to a U.S. Environmental Protection Agency (EPA) study in the southwest, the solar energy that falls on an area of 100 miles by 100 miles would sufficiently meet all of the nation's electricity requirements. As buildings cover more and more of the earth's surface, our choice of materials determine how much of that heat and light will be absorbed and stored by the roofs that cover them.

A Cool Idea – Moving Energy without Energy

Unfortunately, this vast supply of energy is a burden as often as it is a boon. On hot, sunny summer days, a peculiar situation exists in commercial buildings. When the heat transfers inside, large amounts of electricity are consumed by air conditioning systems to remove the heat from the building when, with the proper use of technology, it just as easily could be reflected back into the atmosphere.

A white surface doesn't need energy to move energy. Light from the sun is scattered by white surfaces through a physical process that is much more efficient than the heat pumped or moved by using air conditioners. In this sense, a white surface is equivalent to a renewable resource for cooling buildings. Moreover, since air-conditioner use peaks at the same time in various regions, providing electric power to air conditioners often determines the energy generating needs of a region. The bottom line is that peak electric loads are often the criteria on how electricity is priced.

Reflecting the Damage and Measuring its Value

A key property of a white coating is its reflectance or *reflectivity*. Imagine a 100-watt light bulb with its total intensity reflected downward on one square foot of roof surface. Then imagine a two-dimensional array of these light bulbs spaced one foot apart over a large expanse of roof, and you will begin to appreciate the potential for solar damage on a rooftop. Installing a coating with a reflectance of 0.60 would have the same effect as replacing the 100-watt bulbs with 40-watt bulbs.

With growing recognition of reflectance as an important design parameter, a strict set of standards are used by organizations, such as the Cool Roof Rating Council (see October 2010 ***Roofing Florida*** magazine), to measure reflectance values across the entire solar spectrum, including infrared wavelengths. Accordingly, accurate values for specific materials and coatings are becoming readily available.

Thermal Emittance

Emissivity or thermal emittance is another property typically listed in the specifications for white coatings. Since roofs can cool by other means than radiative heat transfer (for example, convective cooling by the surrounding air), products should not be chosen based solely on this value. Fortunately, many white coatings on the market include high values for both of these properties.

Why White Coatings are White

The beauty of a white coating is that metal oxide pigments scatter particles of light by the same mechanism that light is scattered by the water droplets in a cloud or fog – including reflection of invisible infrared light.

From the roof's perspective, the effect of scattering is the same as if the photons never arrived on the roof. This ability to reflect photons is characterized by the reflectance of a coating. Most white coatings have a very

This metal roof is partially covered with a white coating. The coated half of the dome contrasts sharply with the uncoated half midway through the application process.

high reflectance across all visible wavelengths and a high reflectance for near infrared radiation (NIR).

The property of blocking ultraviolet radiation is not related to the color of the roof.

Interestingly, it is also possible to make a coating that has good reflectance but is not white. In this case, the coating strongly reflects infrared wavelengths, while it absorbs some light in the visible range.

Binders, Pigments, Primers

A white coating typically consists of a binder that blends an organic or silicone compound with pigments and other additives. The coating is commonly classified according to the type of binder incorporated into the mixture.

Most binders consist of elastic polymers with elongation and tensile characteristics (i.e. elastomers) that allow them to return to their original shape after stretching or damage. In white coatings, the elastomer binder is the viscous, pliant material that bonds the pigments and allows them to adhere to the surface.

Primers can be used to improve adhesion between roof surfaces and coatings or for adding other qualities to the system. For example, a rubber roof coating may provide better adhesion to a rubber roof membrane or a coating intended for sprayed polyurethane might provide a better permeability rating when used on that particular type of roof.

Proper preparation and application by a professional roofing contractor will strongly influence the subsequent life and performance of a roof coating system. In some cases, manufacturers may require contractors to undergo training before installing their product.

Permeability and White Coatings

Reflectivity is not the only reason we use roof coatings. It's good to remember that although many white coatings are waterproof, many are not. The property of permeability (perm rating) to liquid water, water vapor and gases varies greatly depending on the coating.

Perm ratings should not be confused with weatherability. A coating with low permeability still may require a protective topcoat to insure satisfactory weathering resistance.

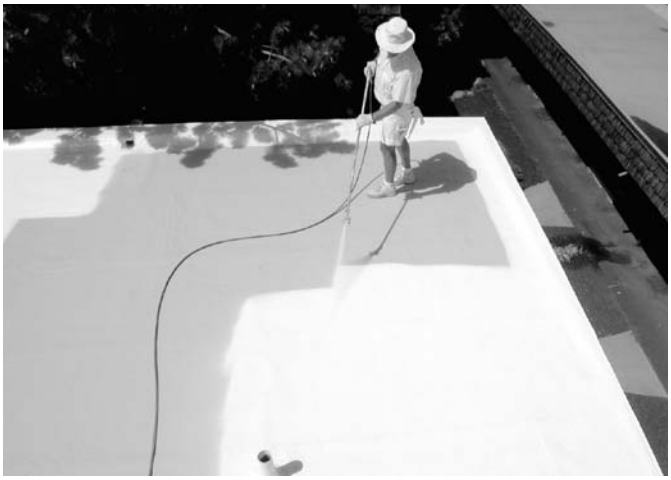
As Time Goes By

Generally, a small decrease in reflectivity occurs over time, depending on several factors. While wind-blown dirt and dust are capable of decreasing the reflectivity of white coatings it still protects against UV radiation, even when foreign particles reduce the reflectivity.

To maintain their reflectivity, roofs may be periodically refreshed with a new topcoat, typically for much less than the cost of the initial coating.

It's Your Turn

The case for using white coatings is hard to dispute but easy to dismiss without the facts to argue your claim.



White coatings can be applied on many roof types, including this old BUR on an apartment building. The white coating is sprayed over a base coat on top of an old built-up roof.

Energy consumption and sustainability in all types of building products is both a legislative and environmental priority that can no longer be ignored. Let's start at the top by insisting that the roofing systems on our buildings work to benefit both our customers and the future of our planet.

About the Article

The content of this article has been excerpted from *A Practical Guide to White Coatings – How to Talk to Building Owners about Cool Roofs* by Steve Heinje and Tom Meyer, originally published in the February 2007 issue of RCI Incorporated's technical journal *Interface*.

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