COOL ROOF COATINGS - THE GREEN DESIGN

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When US Vice President Al Gore, alongside Mayor Bloomberg, launched last September the "NYC Cool Roofs" Initiative by saying: "the threat we face from the climate crisis is unsurpassed and smart policies like installing cool roofs are one way that we are going to meet the challenge", he was echoing previous statement from Energy Secretary Chu, earlier that same year, who was pushing white or reflective roofs as the lowest cost climate strategy.

That demonstrates enough the fundamental role building retrofit is intended to play in saving energy and reducing cooling costs new administration's policies.

Basically, dark-colored roofs absorb heat and increase cooling costs. By coating the roofs white (or paler color), a "cool roof" reflects heat away and keeps the building more comfortable. Cool roof coatings help roofs to last longer, increase the efficiency of air conditioning equipment and greatly reduce peak energy use to avoid brownouts of blackouts during hot summer months.

The cool roof coatings market is a very dynamic segment that is evolving quite rapidly. In 2007, the ChemQuest Group pegged the value of the cool roof coatings market at $430 to $440 million, with white elastomeric products accounting for $290 million and colored coatings containing infrared (IR) reflective pigments making up the remainder. According to Michael Growney of Kusumgar, Nerlfi & Growney, the overall roof coatings market is valued at $750 million. Cool roof coatings account for more than half of the roof coatings market in the U.S. and, in general, are growing faster than the roof coatings market overall.

White coatings, which are largely acrylic-based materials that are field-applied on flat commercial roofs, have been employed for about 10 years and are growing at a rate of 11-12% annually, according to The ChemQuest Group. In the past few years, coil coatings containing IR reflective pigments that are applied to metal roofs have been developed in a range of shades that are attractive for residential applications. These factory-applied coatings are growing at the more rapid rate of 15-17% per year.

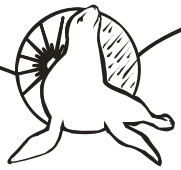
White coatings - The white coating is sprayed over a base coat on top of an old built-up roof Source: Interface, February 2007

There appear to be two key drivers for the cool roof coatings market, both of which relate to reduced energy consumption. The first driver originates with consumers who are looking to lower air conditioning costs and be more environmentally conscious. The second is regulatory based, as several states and cities in the U.S. have passed, or are planning to incorporate, requirements for cool roof performance in their building codes (Energy Star and California Title 24, for example).

To date, the interest in cool roof coatings has largely been generated in the warmer climates of the United States. Outside of the U.S. there has not been much demand for these products yet. Nevertheless, anyone that has cooling demands will eventually be interested in cool roof technology. Therefore, it is foreseeable that countries located in the Southern Hemisphere - Australia, parts of Asia, and Central and South America - will likely be interested in cool roof coatings eventually, adding to the tremendous potential of the market.

Even without expansion beyond the US market, the potential is significant. With the development of cool roof coatings for metal roofs, coatings producers and their suppliers have a new surface area to coat that was not available just 10 years ago. The value of that opportunity is approximately $10 billion.

A white coating consists of a binder blended with pigments and other additives. Most white coating products can be conveniently classified according to the binder they use. Binders usually are made of an organic or silicone compound. Most binders are elastic polymers with elongation and tensile characteristics; i.e., elastomers, which have the ability to return to their original shape after being stretched or deformed. In white coatings, the elastomer binder is the viscous, pliant material that bonds the pigments and makes them adhere to the surface. Common elastomers



used as binders in white coatings include acrylic, silicone, rubber, vinyl, and urethane. Titanium dioxide and zinc oxide are the common pigments that impart a bright white color to the coatings. However, other pigments can be combined with these to yield a variety of pastel colors. Some cool colored pigments reflect heat in much the same manner as chlorophyll reflects heat from plants. They are dark but don't get that hot. Such "IR white" pigments are made of multi-metallic oxides rather than traditional metal oxides such as chrome oxide and iron oxide, which are IR-black.

The majority of white coatings in use today are water-based. These products, often referred to as latex coatings, are available in a variety of polymer types. The water in latex coatings serves as a liquid carrier, allowing the pigment and binder to be spread onto the surface as a thin coating. For some white coatings, organic solvents are used as the liquid carrier; while others, often referred to as reactive coatings, may have sufficient flowability to eliminate the need for a liquid carrier. Reactive coatings are generally prepared with multiple-part resins often blended onsite, before curing. White coatings can be applied to practically any roofing membrane or system. They are commonly applied to sprayed polyurethane, metal, single-ply rubber, and modified bitumen roofs. They can even be applied to certain kinds of asphalt, built-up roofs. It is important to establish compatibility between the white coating and the underlying roof surface. Primers are useful for improving adhesion between roof surfaces and coatings or for imparting additional properties to the roof coating systems. 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 ("perm") rating needed on such a roof. Most white coatings impart greater reflectivity and UV protection to the system.

Acrylic coatings are breathable, which means they have a high moisture vapor transmission rate or permeability. Silicone coatings, as well as many urethanes, are also classified as breathable types. Butyl rubbers, Hypalons, and Neoprenes have a very low permeability (i.e., they are highly resistant to moisture transmission). The same applies to asphalt-extended, moisture-cure polyurethanes and SEBS-modified, cut-back, asphalt coatings.

Loss of solar reflectivity remains one of the key limitations of most of waterborne coatings. According to the EPA (US Environmental Protection Agency), traditional acrylic coatings typically lose about 20% of their total solar reflectivity, and much of this is lost just in the first year. Reflectivity generally drops to 55% after three years. The industry is working to overcome these limitations. For example, new technologies based on fluorine (water-based fluoropolymer resin) are claimed to retain reflectivity of over 80% for more than 10 years while remaining flexible, mildew resistant, and color fast.

Developments in pigment technologies are also making it possible to expand color options beyond white or very light shades. With the development of solar reflective pigments, colors can now be formulated to meet 65% reflectivity. These developments are especially targeted to residential applications, consumers continuing to gravitate toward the aesthetic appeal of the darker shades and designs. Therefore, advancements in coating technology for metal roofing have focused around the development of darker shades of pigments - Infra-Red reflective pigments - that retain the ability to provide the desired level of solar reflectivity and emittance.

Reflective Roof Coatings - Metal Roof Retrofit
Source: Washington State University

Demand for cool roof coating technology is expected to rise significantly. We should see increasingly more municipal as well as state requirements for cool roofs. Translated, that means more coating products will be produced to meet demand for new as well as existing low-slope roofs. A wider range of products dedicated to each substrate type will be formulated as a result. Building codes will also likely dictate sufficiently sloped roof designs, which will benefit the entire roof coatings industry. But, according to Energy Secretary Chu's Geoengineering concept, a global "cool roofs" strategy can achieve far bigger benefits - the equivalent of several trillion dollars worth of CO_2 reductions - since it can increase the albedo (reflectivity) of the planet, thereby directly reducing the absorption of incoming solar radiation and hence planetary warming. The strategy proposed "is equivalent to taking the world's approximately 600 million cars off the road for 18 years."

The pace is being set and we will likely see, within the next decade, innovative products pushed through while roofing professionals will achieve greater awareness of, and compliance with, new technologies and regulations.

Definitions

Albedo: The albedo of an object is the extent to which it diffusely reflects light from light sources such as the Sun. It is therefore a more specific form of the term reflectivity. The word is derived from Latin albedo "whiteness", in turn from albus "white". The range of possible values is from 0 (dark) to 1 (bright).

Emittance: The amount of absorbed heat that is radiated from a roof, expressed as a number between zero and one. The higher the value, the better the roof radiates heat.