



Hot Topics in Cool Roofing

What is a cool roof? Does a roof have to be white to be cool? With the focus on energy efficiency, the roofing industry is working hard to provide architects, builders and homeowners with products that will enhance the energy efficiency of their projects and homes. Emissivity and reflectivity are two hot topics in cool roofing. Products with higher emissivity and reflectivity rates are able to reduce the cooling load, thereby adding to the energy efficiency of a building or home.

Oak Ridge National Laboratory conducted a study, commissioned by the Department of Energy's Buildings Technologies Program, to test different products and roof assemblies. The DOE funded the study because of the development of infrared-blocking color pigments. The first IR-blocking color pigments were used in military camouflage to hide objects from heat seeking devices, and the DOE was interested in the possible benefits of the "cool" pigment when applied to roofing materials, especially stone coated metal roofs. IR-blocking granules are both highly emissive and reflective.

Stone coated metal panels are generally installed on a counter-batten and/or batten system. Therefore, the testing also addresses the effect of ventilating the space between the deck and the metal panels on energy savings. Ten decks in all were tested: a control deck covered in typical dark grey asphalt shingles applied direct to deck; one was painted metal fastened direct to deck; two were stone coated with conventional (non IR-pigment) granules on a counter-batten and/or batten system; and six were stone coated with IR-pigment granules and applied on a counter-batten and/or batten system. Venting of the space was achieved via mesh-covered openings at the eave and at the ridge.

Field data covered summer and winter conditions for one year. Summer data was collected during the daylight hours for a week in July. The data measured was the amount of heat that permeated the attic floor into the conditioned space. Reduce the heat permeating the attic floor and you reduce the cooling load. Instrumentation for measuring temperature and heat flow were included in the deck design, as were instruments to measure solar reflectance and thermal emittance.

Testing on the metal panels covered with IR-pigments returned expected results. When compared to the

asphalt shingle roof, the test roof covered with an IR-pigment granule, installed on a counter-batten and batten system, reduced heat transfer by about 45% - however, only 15% could be attributed to the IR-pigment granules, and 30% of the reduction could be attributed to over the deck venting.

The metal panels with dark grey conventional granules were then compared to the asphalt shingle roof - both very similar in reflectance and emittance. Again, it was found that by venting between the panels and the deck there was a reduction in heat flow through the deck which accounts for a lower amount of heat entering the attic and penetrating the attic floor.

When the light grey IR-pigment stone coated panels were compared to the dark grey conventional stone coated panels - both on a counter-batten and batten system - it was noted that the conventional dark grey granular coated panels swept away more than twice the amount of heat flow than the light grey IR-pigment granular coated panels. The heat produced by the darker, conventional granules increased the airflow thereby increasing the amount of hot air swept away from the deck. It can be concluded that there is a potential tradeoff between solar reflectance and over the deck venting when modeling for energy efficiency.

The winter condition testing produced an additional benefit. All of the stone coated metal roofs (conventional and IR-pigment granular coated), applied either to counter-battens and/or battens, reduced heat loss that takes place on a cold night better than the asphalt shingles applied directly to the deck - negating the winter heating penalty associated with cool roof constructions.

The test concluded that over the deck "venting of the stone-coated metal roofs is just as important as the solar reflectance for reducing the heat gain into the attic and conditioned space."

