

Tile enters the environmental arena

by Tom Bollnow

Long considered one of the more durable and sustainable steep-slope roof covering materials, clay and concrete roof tile products have been becoming more energy-efficient and environmentally friendly. The development of lightweight and cool-colored tiles has resulted in increased availability of tile roof systems on existing structures and the use of tile roof systems to achieve energy-saving goals.

Lightweight tile

To be classified as lightweight, tile roof covering material must weigh less than 6 pounds per square foot (psf) at oven-dry weight. A key factor in the design and performance of lightweight tile roof systems is a tile's water absorption property. Water absorption can increase a tile system's weight after a rainfall and possibly affect a building's structural integrity. For example, a tile product that weighs 5 psf at oven-dry weight and has a 10 percent water absorption rate by weight will weigh 6.05 psf when wet.

A lightweight tile load of less than 6 psf allows tile to be used as a roof system replacement on existing structures often without requiring a structural load analysis per local building departments. However, lightweight tile may sacrifice strength and low water absorption properties to achieve the required light oven-dry weight; therefore, the use of lightweight tile is not recommended for all geographical areas. Locations where lightweight tiles generally are not recommended include regions of freeze-thaw cycling, moderate to heavy rainfall and frequent hail.

Cool-colored roof tile

During 2002, the California Energy Commission (CEC) sponsored a roofing industry program titled Development of Cool Colored Roofing Materials. CEC asked Lawrence Berkeley National Laboratory (LBNL), Berkeley, Calif., and Oak Ridge National Laboratory (ORNL), Oak Ridge, Tenn., to collaborate with the roofing industry to develop and produce colored roofing materials with higher reflectivities, targeting the homebuilding industry. Roofing industry participation consists of a group of product and component manufacturers referred to as Industry Partners and a Project Advisory Committee composed of various roofing and housing industry organizations.

Clay and concrete roof tile products have been becoming more energy-efficient

The focus of the collaboration was to develop primarily steep-slope roof covering materials with increased solar reflectance while maintaining an aesthetically pleasing color palette. The original research focused on pigment technology to increase reflectivity, maintain color and increase surface reflectivity on coating technology. Both processes have been successful for clay and concrete tile.

One of the ultimate goals of the CEC-sponsored initiative is to establish realistic requirements for cool roofs in California's 2008 Building Energy Efficiency

Standards (California's Title 24). The pending legislation would require tile and certain other steep-slope roof systems to have reflectivities greater than or equal to 0.40 and emissivities greater than or equal to 0.75. Based on pigment and coating augmentation, the clay and concrete tile being produced can increase solar reflectance from an initial range of 0.04 to 0.33 to a range of 0.41 to 0.48 with the greatest increase in the darker colors. Lighter colored tile can achieve even higher reflectivity values with a range of 0.56 to 0.77.

An additional energy-savings benefit also is being proved during the course of data gathering for tile roof systems. Tiles can be installed directly on a deck or above a deck on battens. Field tests conducted at LBNL and ORNL indicate subtile venting (batten installation) causes significant reduction in deck and attic floor heat flows. This benefit significantly should improve summer cooling performance and reduce winter heat loss.

A new benefit

Clay and concrete roof tiles are recognized for durability and sustainability. Lightweight tiles used within geographic and climatic parameters can allow existing homes to have the advantages of tile without requiring significant structural alterations. The development of cool-colored tiles combined with the benefits of batten installation can have a meaningful effect on energy conservation and environmental preservation. 🌱 🌞 ❄️

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