Membrane Materials with Adaptive Heat and Light Transmission Properties for Applications in Building Envelopes

Corresponding AUTHOR: Barbara PAUSE

Textile Testing & Innovation, LLC
7161 Christopher Court
Longmont, CO 80503, USA
pause@textile-testing.com

Abstract

New membrane materials for applications in building envelopes have been developed which possess unique properties of adaptive heat and light transmission. The changes in heat transfer and translucency are triggered by temperature. The effects are due to the application of phase change material (PCM). PCMs are able to change their physical state, i. e. from solid to liquid, within a certain temperature range. During such a melting process, the PCM absorbs and stores a large amount of latent heat. The temperature of the PCM and its surrounding remains nearly constant throughout the entire process. The fact that PCMs absorb large amounts of latent heat without any temperature change makes them an innovative means of heat storage.

In the new membrane material's design, the PCM is cross-linked into a polymeric compound which is coated onto a textile carrier material. Applied to a building's envelope, the PCM incorporated into the membrane material regulates the heat transfer into and out of the structure starting at given trigger temperatures and adapts the heat flux to prevailing requirements. This capability enhances the thermal comfort, reduces the building's air-conditioning and heating demands, and therefore, makes the structure more energy efficient. Furthermore, by minimizing the daily temperature fluctuations, the material's aging process will be delayed substantially which enhances the service life of the structure and contributes to its sustainability. While changing from solid to liquid, the PCM's appearance transforms from opaque to transparent. Incorporated into a transparent carrier material, the phase change causes a change in the light transmission which is also triggered by temperature.

In the presentation, the newly developed membrane materials will be introduced and test results received in a side-by-side comparison of two tensile structures will be discussed. Based on the test results, energy saving have been calculated by means of a computer model which will be presented as well.