Poly(Ethylene Glycol)-Silicone Containing Phase Change Polymer for Thermal Energy Storage

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Abstract : The global energy crisis has led to extensive research on alternative sources of energy. The gap between energy supply and demand can be met by thermal energy storage techniques, of which latent heat storage is most effective in the form of phase change materials (PCMs). Phase change materials utilize latent heat absorbed or released over a narrow temperature range of the material undergoing phase transformation, to store energy. The latent heat can be utilized for heating or cooling purposes. It can also be used for converting to electricity. All these actions amount to minimizing the load on electricity demand. These materials retain this property over repeated number of cycles. Different PCMs differ in the phase change temperature and the heat storage capacities. Poly(ethylene glycol) (PEG) was cross-linked to hydroxyl-terminated poly(dimethyl siloxane) (PDMS) in the presence of cross-linker, tetraethyl orthosilicate (TEOS) and catalyst, dibutyltin dilaurate. Four different ratios of PEG and PDMS were reacted together, and the composition with the lowest PEG concentration resulted in the formation of a flexible solid-solid phase change membrane. The other compositions are obtained in powder form. The enthalpy values of the prepared PCMs were studied by using differential scanning calorimetry and the crystallization properties were analyzed by using X-ray diffraction and polarized optical microscopy. The incorporation of silicone moiety was expected to reduce the hydrophilic character of PEG, which was evaluated by measurement of contact angle. The membrane forming ability of this crosslinked polymer can be extended to several smart packaging, building and textile applications. The detailed synthesis, characterization and performance evaluation of the crosslinked polymer blend will be incorporated in the presentation.

Keywords : phase change materials, poly(ethylene glycol), poly(dimethyl siloxane), thermal energy storage
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