World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

UV-Cured Thiol-ene Based Polymeric Phase Change Materials for Thermal Energy Storage

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Abstract : Energy storage technology offers new ways to meet the demand to obtain efficient and reliable energy storage materials. Thermal energy storage systems provide the potential to acquire energy savings, which in return decrease the environmental impact related to energy usage. For this purpose, phase change materials (PCMs) that work as 'latent heat storage units' which can store or release large amounts of energy are preferred. Phase change materials (PCMs) are being utilized to absorb, collect and discharge thermal energy during the cycle of melting and freezing, converting from one phase to another. Phase Change Materials (PCMs) can generally be arranged into three classes: organic materials, salt hydrates and eutectics. Many kinds of organic and inorganic PCMs and their blends have been examined as latent heat storage materials. PCMs have found different application areas such as solar energy storage and transfer, HVAC (Heating, Ventilating and Air Conditioning) systems, thermal comfort in vehicles, passive cooling, temperature controlled distributions, industrial waste heat recovery, under floor heating systems and modified fabrics in textiles. Ultraviolet (UV)-curing technology has many advantages, which made it applicable in many different fields. Low energy consumption, high speed, room-temperature operation, low processing costs, high chemical stability, and being environmental friendly are some of its main benefits. UV-curing technique has many applications. One of the many advantages of UV-cured PCMs is that they prevent the interior PCMs from leaking. Shape-stabilized PCM is prepared by blending the PCM with a supporting material, usually polymers. In our study, this problem is minimized by coating the fatty alcohols with a photo-cross-linked thiol-ene based polymeric system. Leakage is minimized because photo-cross-linked polymer acts a matrix. The aim of this study is to introduce a novel thiol-ene based shape-stabilized PCM. Photo-crosslinked thiol-ene based polymers containing fatty alcohols were prepared and characterized for the purpose of phase change materials (PCMs). Different types of fatty alcohols were used in order to investigate their properties as shape-stable PCMs. The structure of the PCMs was confirmed by ATR-FTIR techniques. The phase transition behaviors, thermal stability of the prepared photo-crosslinked PCMs were investigated by differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). This work was supported by Marmara University, Commission of Scientific Research Project.

Keywords : differential scanning calorimetry (DSC), Polymeric phase change material, thermal energy storage, UV-curing
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020