Exploring the temperature-dependent thermal stability of nano-enhanced phase change materials: An experimental study using eicosane as the base material

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ABSTRACT

Recently, studying phase change materials (PCMs) has brought many researchers' attention to be applied in thermal energy storage and battery thermal management (BTM) applications. Nano-materials have been used recently to improve the advantages of the PCM which makes them suitable materials to be used in thermal management systems. Moreover, the selection of the nanomaterials and the proper concentration of nano-particles in PCM affects the thermophysical characteristics of PCM. According to the fact that PCM requires to be thermally stable, the principal aim of this study is to analyze the thermal stability of PCMs composites by loading different mass fractions of CuO nano-particles. In order to add nano-particles to the eicosane-based PCM, a two-step method has been used. The thermal stability of the Nano-enhanced phase change materials (NePCM) has been measured by using the thermogravimetric analyzer. Results demonstrated that 0.5 wt% is the best value of additive nano-particle which showed a remarkable increment in thermal stability. Therefore, all the presented results indicate the importance of selecting an optimal PCM nano-composite for various applications including NePCM-based thermal energy storage and BTM systems. The brand and model of the device used in this study are Hitachi and STA7000 respectively.

KEYWORDS

Phase change material; CuO nano-particles; Nano-enhanced phase change materials; Thermal stability

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