The effect of thermal cyclic variation on the thermophysical property degradation of paraffin as a phase changing energy storage material

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ABSTRACT

Thermophysical properties of phase change material (PCM) and their thermal stability over their lifetime are necessary to be understood to build an efficient latent heat storage system. This study aims to investigate the degradation in thermophysical properties of a phase change material (paraffin wax) because of repeated thermal cycling. The samples were prepared by heating the PCM using bottom heat source and cooled at ambient temperature. This process was repeated over the period of 200 cycles. The thermal conductivity, thermal properties (stability and void formation) and the density of the samples were investigated. The voids formation has a significant effect on the thermophysical property degradation. Differential scanning calorimeter (DSC) results showed 25.17% decline in the latent heat capacity and 33.72% drop in peak degradation temperature from cycle 1–200. The sample mass was reduced by 33.72% at 600 °C after 200 cycles. In addition, after 200 cycles the thermal conductivity increased by 12% hence, repeated thermal cycling showed a significant increment in its thermal conductivity. This result indicates the potential of paraffin wax as a heat storage material in Latent heat thermal energy storage system. The decline in the percentage of property and stability is very low after 200 cycles compared to previous studies.

KEYWORDS: PCM; Paraffin wax; Thermophysical properties; Degradation; Voids

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