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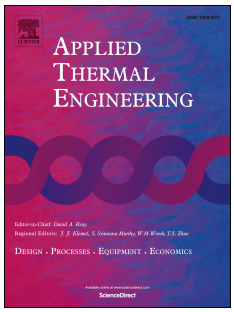

Thermal properties measurement and heat storage analysis of paraffin-nanoparticles composites phase change material: comparison and optimization

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PII: S1359-4311(15)00786-3

DOI: 10.1016/j.applthermaleng.2015.07.083

Reference: ATE 6888

To appear in: *Applied Thermal Engineering*

Received Date: 9 May 2015

Revised Date: 26 July 2015

Accepted Date: 27 July 2015

Please cite this article as: A. Babapoor, G. Karimi, Thermal properties measurement and heat storage analysis of paraffin-nanoparticles composites phase change material: comparison and optimization, *Applied Thermal Engineering* (2015), doi: 10.1016/j.applthermaleng.2015.07.083.

Thermal properties measurement and heat storage analysis of paraffin-nanoparticles composites phase change material: comparison and optimization

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Abstract:

Thermo-physical properties of phase change materials (PCMs) are important in latent heat thermal energy storage applications. At high heat flux levels, the poor thermal conductivity of PCMs limits their thermal control performance. This problem can be solved by employing composite materials with a better heat conducting matrix. In this study, various nanoparticles such as SiO_2, Al_2O_3, Fe_2O_3, ZnO and their combinations were used as thermal conductivity promoter to produce modified paraffin samples by direct-synthesis method. Thermal properties such as phase change temperatures, latent heat of melting and solidification and heat capacities of composites were measured by differential scanning calorimetric technique. Morphological properties identifying the components that make up the sample and dispersion of nanoparticles in paraffin mixture were characterized using scanning electron microscopy. Measurements show that thermal conductivity and diffusivity of the composites are substantially enhanced by increasing the nanoparticles mass fractions at the tested temperature. The best result was obtained for samples containing Al_2O_3 nanoparticles. The lowest decrease in latent heat was also observed for PCM with Al_2O_3 nanoparticles. As a conclusion, Al_2O_3 nanoparticles showed significant potential for enhancing the thermal storage characteristics of the paraffin mixture.

Keywords: Nanocomposite-enhanced phase change materials (NEPCMs); Thermo-physical properties; Nanoparticle; Thermal diffusivity;

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