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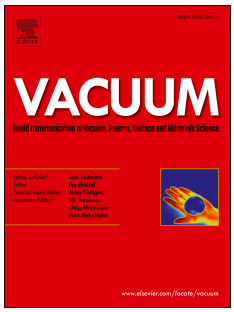

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Thermal and microstructural properties of paraffin/diatomite composite

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Abstract

The present work is devoted to the study of the impregnation of both the raw and calcined Algerian diatomite with a mixture of paraffin wax (PW) and liquid paraffin (LP) in order to obtain composite PCMs with a melting temperature below 30°C and an appropriate latent heat. Structural, microstructural and thermal properties were studied by X-ray diffraction (XRD), scanning electron microscopy (SEM), Fourier transform infrared spectroscopy (FT–IR), differential scanning calorimetry (DSC) and thermogravimetric analysis (TGA). The raw diatomite contains many phases such as quartz (hexagonal SiO_2), tridimite (trigonal SiO_2) corundum (α-Al_2O_3, trigonal), $CaSO_4$ (orthorhombic) and calcite ($CaCo_3$, trigonal). After calcination, the main phases are quartz, tridimite, calcite and $CaSO_4$. The SEM micrographs show that the PCMs are well impregnated into the diatomite pores. The FT–IR results reveal the absence of chemical interaction between paraffin and diatomite. The paraffin/calcined diatomite composite PCMs exhibits a melting temperature of 28.44°C and a latent heat of about 56.40 J/g. Due to their thermal reliability and thermal energy storage performance after thermal cycling, the prepared composites PCMs are good candidates for thermal energy storage in buildings.

Keywords: Diatomite; Phase change materials; Composite PCMs; Thermal properties; Microstructure.