ABSTRACT

Phase change materials (PCMs) are widely used for heat storage due to their high energy storage density during their melting process and their defined operating temperature. Latent heat storage by employing solid-liquid organic PCMs have drawn attention for decades in improving their thermal conductivities for efficient solar energy management and had become one of the main topics of research for the last 20 years [1]. This paper mainly focuses on the preparation, characterization and thermal properties of the shape-stabilized paraffin/graphene composite PCMs prepared by introducing pre-mixed graphene dispersion with paraffin melt. By constantly heating, the solvent was evaporated and left behind a grayish product with uniformly distributed graphene nanostructures at weight ratio of 10, 20 and 30%, respectively and designated as G10, G20 and G30 in the following paragraphs for simplicity. Graphene are characterized by SEM, XRD and Raman techniques while the thermal properties of the PCMs were evaluated by thermogravimetric analyzer (TGA) and differential scanning calorimeter (DSC).

The SEM image characterizing the morphology of graphene was shown in Fig. 1a. It consisted of smooth sheets of planar graphene randomly aggregated to form stacked-layers structures. Fig. 1b displays the XRD patterns of graphene employed in this study confirms well with pristine grapheme [2]. Raman spectroscopy is an important, non-destructive tool used to study the structural changes of grapheme-based materials. It showed in Fig.1c that there are two prominent peaks at 1323 and 1579 cm⁻¹, corresponding to the D and G bands, respectively [3].

Graphene-based nanostructures, such as graphene oxides, reduced graphene, are hardly dispersed with paraffin owing to their hydrophobic nature. Accordingly, certain amount of surfactant, such as dioctyl sodium sulfonsuccinate (AOT) in n-octane, is indispensible for homogeneous paraffin/graphene composites. By varying the weight ratio of graph...