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Thermo optical switching of paraffin wax hosting carbon fillers

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Thermo optical switching (TOS) transmission of paraffin wax hosting different concentration of powder Graphite or Graphene was examined. Two series of graphite/paraffin wax and graphene/paraffin wax were studied. In the composite, paraffin wax was used as a Phase Change Material (PCM) while Graphite or Graphene used to enhance thermal properties of paraffin wax. Due to large particle size of graphite, dispersing toluene into paraffin wax graphite composites was done. Optical mimcroscopy were used in characterize the microstructure of the composite. It is found that graphene/paraffin wax and graphite/paraffin wax dispersed in toluene have a homogenous distribution while samples without toluene have agglomeration and precipitation at the bottom of the tube. TOS transmission versus time and temperature are measured by using test tube with inner diameter 11 mm for bulk composites. Differential Scanning Calorimetric (DSC) was measured for the prepared samples. The melting temperature, latent heat of fusion, heat gained and heat lost of paraffin wax-graphite or graphene composites were determined. The melting temperature of Paraffin wax hosting graphite without toluene is close to those of pure paraffin wax. The melting temperature, latent heat, heat gained and heat loss of two phase transitions measured from DSC for paraffin wax-graphite composite dispersed in toluene decrease as graphite to paraffin wax ratios increase. DSC for paraffin wax-graphene composite shows that, the temperature is affected gradually as the graphene content increase, the sample of high graphene concentration (0.007) shows strongly decrease of the melting temperature, latent heat, and heat gained and heat lost. TOS transmission of paraffin wax hosting graphite or graphene is studied under electric heating, lowering the switching temperature (T_i), saturation temperature (T_f) and the corresponding time for these transitions are observed for graphene. theses are due to the high thermal conductivity of graphene over that of graphite. The sharp enhancement of lowering the time needed for switching for paraffin wax-graphene composites is due to high thermal conductivity 5000 W/m°C while the thermal conductivity of graphite 440 W/m°C. This measurement supports the using of paraffin wax (PCM) hosting carbon fillers as Thermo Optical sensing material for Thermo Optical Switching (TOS) device applications.

Biography

Abeer Salah has completed her PhD from Cairo University. Her PhD is concered with nonlinear characterization of different nanomaterials via Z scan technique. She is intersted in optical characterization of materials through studying the transmission, photoluminescence, absorption, etc.

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