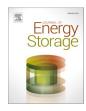


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**Research Papers** 

# Experimental investigation on the performance of binary carbon-based nano-enhanced inorganic phase change materials for thermal energy storage applications

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#### ARTICLE INFO

### ABSTRACT

Keywords: Phase change materials Graphene Multi-walled carbon nanotubes Thermal conductivity Energy Thermal energy storage Phase change materials (PCMs) are considered potential resources for Thermal energy storage (TES) applications. However, the PCMs are limited because of their lower thermal conductivity, resulting in a significant decrease in heat transport and energy storage capability. The foremost objective of the present research is to formulate a novel salt hydrate PCM filled with binary carbon-based nanoparticles (graphene and multi-walled carbon nanotubes) at various weight concentrations and examine the thermophysical properties. A two-step approach is used to formulate binary nanomaterials dispersed salt hydrate PCM. The formulated binary nanocomposite's thermo-physical properties like morphological behaviour, thermal stability, chemical stability, melting enthalpy, optical performance, rate of heat transfer and thermal reliability were characterized. The binary nanoparticleenhanced nanocomposites can form a decent thermal network, resulting in a remarkable enhancement in thermal conductivity by 160 % (1.2 W/mK) compared to pure salt hydrate. Moreover, a remarkable improvement in optical absorptance and a reduction in optical transmittance by 82.55 % for 0.7 wt% graphene and 0.07 wt% MWCNT enhanced salt hydrate PCM (SAHGrM-0.07) than pure salt hydrate PCM. In addition, the formulated nanocomposites possess excellent heat storage capability, chemical and thermal stability after 300-thermal cycling. The binary carbon-based nanoparticle-enhanced salt hydrate nanocomposites offered acceptable thermal and chemical stability, thermal reliability, and heat transmission characteristics, by this means reflecting its appropriateness for medium-temperature solar TES applications.

#### 1. Introduction

The worldwide energy utilization pattern remains changing from

fossil fuel-based energy to renewable energy [1]. Renewable energy and energy storage technology become research hotspots worldwide [2]. It is being trusted that solar power utilization is able to clean energy. However, solar energy's fluctuating and intermittent nature is inevitable [3].

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