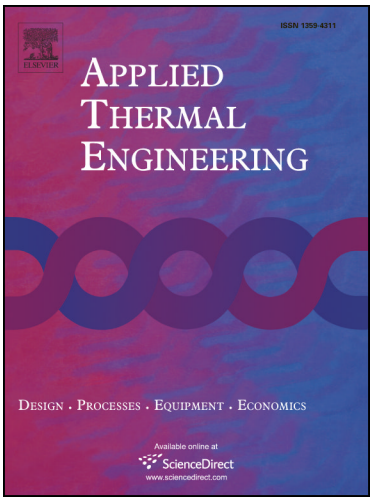

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A Novel Graphite-PCM Composite Sphere With Enhanced Thermo-Physical Properties

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Highlights

1- A novel cold thermal energy storage device based on graphite-phase change material sphere composite

2- The benefit of using graphite-based phase change material in providing fast heat charge and discharge

3- Graphite-phase change material sphere composite with no phase change material super-cooling and well containment

4- Thermo-physical stability of graphite- phase change material sphere composite undergo of 200 thermal cycles

Abstract

Cooling is one of the major energy consuming processes in industry; thus the design of efficient and reliable cold energy storage system based on phase change material is an important requirement in many fields. However, the performance of such system is limited by the poor thermal conductivity of most phase change material. This paper provides a novel graphite-phase change material composite sphere, having high thermal conductivity. In this study, two different types of phase change material were used, organic (PureTemp4) and inorganic (water) phase change materials. The measured thermal conductivity of graphite-water and graphite-PureTemp4 composite spheres were 12 and 30 times higher than those of pure water and PureTemp4, respectively. The microstructure of the compressed expanded graphite and graphite-phase change material composites were examined using a scanning electron microscope. The result shows that the phase change material was completely filled the pores and adhered as a thin layer on the graphite surfaces. Differential scanning calorimeter and thermal cycling tests showed no significant changes in thermal properties of the graphite-phase change material composite spheres after 200 thermal cycles. The measured average freezing rates for graphite-phase change material composite and hollow plastic spheres containing the same amount of PCM are 14.42W and 4.58W respectively, while for