A comprehensive review on thermophysical properties and solar thermal applications of organic nano composite phase change materials

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ABSTRACT

The recent advancements in phase change materials (PCM) have made them emerge as a novel class of materials to be deployed in thermal energy storage. An effective strategy to enhance the thermal conductivity of PCM is to disperse highly conductive nano additives. A comprehensive summary of the recent advances over the previous decade in synthesis routes that effectively enhances the thermal conductivity of PCM based on different dimensional nano additives is highlighted. Fundamental mechanisms for thermal conductivity rise, like phonon interaction, interfacial thermal resistance, Vander Waals forces, construction of thermally conductive pathways, were considered. Furthermore, the effect of factors like; aspect ratio, temperature, type of nano additives, and surfactant on thermophysical properties are also studied. An in-depth analysis of various solar thermal applications of Nano-enhanced PCMs (NePCM) integrated systems delivering improved performance is also done. Finally, an outline of economic impact, challenges, and future outlooks in the context of NePCMs are also presented.

KEYWORDS: Nano-enhanced PCMs, Synthesis, Nanoparticle-dimension, Thermal conductivity, Phonon interaction, Interfacial thermal resistance

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