Microencapsulated n-eicosane/SiO_2/TiO_2/PDA phase changing material with enhanced localized surface heating effect and visible light irradiation for efficient solar energy utilization

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To improve the solar energy application efficiency of nano encapsulated phase change materials (PCMs), a novel hierarchical paraffin@SiO_2/TiO_2/PDA composite shell was designed and synthesized by interlayer arrangement onto the microencapsulated n-eicosane. A series of paraffin@/SiO_2/TiO_2/PDA microcapsules were generated through interfacial polycondensation using an emulsion templating scheme, and their microstructures, chemical compositions and crystallinity were investigated extensively. The hybrid composite constitutes a spherical core–shell structural morphology, where interlayer arrangement promotes effective design for efficient solar energy harvesting. This communication confirmed an effective way to improve the structural stability, durability, and enhancement on its solar activity by stimulating the intrinsic properties of the layered materials. The composite system demonstrated in this work shows a great potential for direct solar energy utilization.