A promising form-stable phase change material composed of C/SiO_2 aerogel and palmitic acid with large latent heat as short-term thermal insulation

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Abstract: In this work, palmitic acid (PA) is used as the PCM, while a novel kind of 3D porous carbon/silica composite aerogel (CSA) is involved as porous supporting material to prepare the form-stable PCM composites (PA/CSA). The carbon aerogel supported PCM composite (CA/PA) is provided as control. PCM infiltration mainly occurs for the large pores rather than micropores or mesopores. PA molecules are physically well combined with CA and CSA due to capillary force and surface tension. The addition of amorphous CA and CSA limits the crystalline growth of PA molecules. The CA/PA shows a separated and layered structure while the CSA/PA presents a CSA@PA core-shell structure with a rough surface due to large pores within the CSA pore matrix. The PCM loading mass fraction of CSA/PA (82.2 %) is much larger than that of CA/PA (64.1 %), and liquid leakage test indicates its excellent form-stabilization property. The melting point and melting latent heat of CA/PA sample is 39.73 ºC and 96.27 J/g, respectively, while the melting latent heat of the CSA/PA sample is as high as 187.7 J/g. The CSA/PA possesses excellent thermal stability during cycling test and its short-term thermal insulation property has also been verified in this study.

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