Thermal properties and structural characterizations of new types of phase change material: Anhydrous and hydrated palmitic acid/camphene solid dispersions

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ABSTRACT

There are two kinds of new phase change material (PCM) anhydrous and hydrous palmitic acid/camphene solid dispersions (PA1CA1). They are the mixing of 30.45 wt% amorphous crystalline camphene (CA), 57.32 wt% palmitic acid and the 12.23 wt% water, and they may have turned the matrix into more disorder because of their different bonding natures, molecular weights, and various molecular shapes and size. They could be proved by powder X-ray scattering and small-angle x-ray scattering. Their microstructures are found to be containing of nanometer-sized PA crystallites with lamellar periodicity, and their d spacing is 3.57 nm, dispersed in a partially amorphous plastic CA. The low-temperature differential scanning calorimetry and temperature-history method reveal that the PA phase apparently possesses a relatively high latent heat value inherited from the pristine crystalline PA of 229.7±0.1 kJ $kg^{-1}K^{-1}$. The relatively high specific heat of solid, C_{ps}, for anhydrous PA1CA1 of 2.17±0.06kJ $kg^{-1}K^{-1}$ is originated from the presence of disordered CA matrix. On the contrary, hydrated PA1CA1 could further increase the C_{ps} up to 2.61±0.01kJ $kg^{-1}K^{-1}$.

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