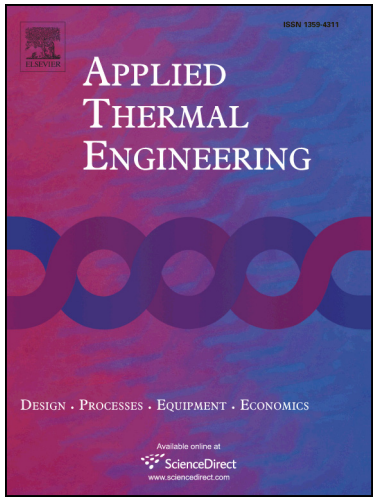

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Binary eutectic mixtures of stearic acid-n-butyramide/n - octanamide as phase change materials for low temperature solar heat storage

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Abstract

We investigated the thermal properties and thermal reliability of stearic acid-n-butyramide and stearic acid-n-octanamide binary eutectic mixtures, as phase change materials for low temperature solar heat energy storage. The solid-liquid phase diagrams of two binary systems were established, and the eutectic compositions of binary mixtures and corresponding thermal properties were verified: (1) stearic acid-n-butyramide, the eutectic composition is 0.551 ± 0.005 mole fraction stearic acid and (2) stearic acid-n-octanamide, the eutectic composition is 0.589 ± 0.005 mole fraction stearic acid. The eutectic compositions have high latent heat of fusion ΔH_m= 198.38 ± 10.22 $J \cdot g^{-1}$, ΔH_m= 198.98 ± 8.56 $J \cdot g^{-1}$ and melting temperature T_{peak}= 337.41 ± 1.93 K, T_{peak}= 336.28 ± 2.00 K for stearic acid-n-butyramide and stearic acid - n-octanamide binary mixture, respectively. A modeling approach on the bases of thermodynamics is employed to predict solid-liquid equilibria of the studied mixtures and their latent heats of fusion. The simulated results are in good agreement with experimental results. The heat capacity of the solid phase measured are 1.69 ± 0.2 $J \cdot g^{-1} \cdot K^{-1}$, 1.61 ± 0.2 $J \cdot g^{-1} \cdot K^{-1}$ and the thermal conductivity of the solid phase are 0.222 ± 0.03 $W \cdot m^{-1} \cdot K^{-1}$, 0.276 ± 0.034 $W \cdot m^{-1} \cdot K^{-1}$ at 298.15 K for stearic acid-n-butyramide and stearic acid-n-octanamide binary mixture, respectively. The mixture has a good thermal stability after 100 melt-freeze cycles. As novel phase