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Latent Heat Recovery Modification from Sodium Acetate Trihydrate due to Structural Changes Caused by Silver Nanoparticles

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Preview Abstract *Abstract*

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Phase change materials (PCMs) have great potential as energy storage devices through the storage of thermal energy at low temperatures. Sodium acetate trihydrate (SAT) is a PCM commonly used for storing thermal energy for non-electric personal warmers, and releases that energy as latent heat during the phase transition from a supersaturated liquid state to a solid, crystal state at room temperature. SAT is an inexpensive, non-toxic PCM. These characteristics make SAT ideal for the development of reusable, non-electric neonatal blankets. This application requires careful optimization of the maximum temperature attained by the SAT solution, balanced by a prolonged heat release that will last hours. It is hypothesized that latent heat release will be prolonged if crystal growth rate is slowed via the interference of additives with the crystallization process. In this work we investigate the effects of adding nanoparticles to a solution of SAT and water. We find that the nanoparticles expedite the crystal growth, but that the growth rate of SAT crystals is non-monotonic with increasing nanoparticle concentration. Powder X-ray diffraction data indicate that the crystal structure is not affected with larger size particles are added, but strongly modified with the addition of 10nm size silver nanoparticles.

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