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Studies on solution crystallization of $Na_2SO_4.10H_2O$ embedded in porous polyurethane foam for thermal energy storage application

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HIGHLIGHTS

- PU-PCM composite with $Na_2SO_4.10H_2O$ solution provided better thermal insulation
- Physical model in COMSOL was developed for phase change of salt solution in PU foam
- Computational approach for solution crystallization using experiment data described
- Computational result validated with experiment result for thermal insulation study

ABSTRACT

Inorganic salt hydrates as a phase change material have the advantage of high latent heat values, high thermal conductivity and are not flammable. Phase segregation is the key downside feature that restricts its application in thermal energy storage application. A PU-PCM composite was prepared by incorporating aqueous saturated sodium sulphate solution, inorganic phase change material (PCM), within open pores of polyurethane (PU) foam. Experimental study on the thermal insulation performance of this composite, aqueous sodium sulphate solution embedded in open cell polyurethane foam, was discussed. This paper presents the computational solving approach for the thermal analysis of this composite having crystallization of sodium sulphate decahydrate, from its aqueous solution, within open pores of PU foam. Thermal study of salt solution in a porous material that undergoes phase change was done using COMSOL Multiphysics software and results were compared with experimental result.

Keywords: Thermal energy storage; Phase change material; Inorganic salt hydrate; Polyurethane foam; Sodium sulphate decahydrate.