Experiments on a lab scale TES unit using eutectic metal alloy as PCM

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Abstract

The behavior of a magnesium and zinc eutectic metal alloy used as thermal energy storage (TES) material is tested in a laboratory scale TES unit. The TES unit consists of two concentric tubes with the central tube surrounded by 67 kg of the metal alloy and two caps at both ends of the tube through which the heat transfer fluid (HTF) flows. Charging (melting) and discharging (solidification) processes of the eutectic metal alloy are performed using synthetic oil as the HTF. The experimental results are used to test the validity of the model via simulations performed with a computational fluid dynamics tool. The results corroborate that phase change materials with high thermal conductivity, such as eutectic metal alloys, are ideal for the evaporation process of water in direct steam generation applications due to the quasi-constant melting and solidification temperatures and to its high heat transfer capacity.

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