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Abstract

Investigation of Thermal Stability of $Mg_{84}Cu_{16}$ as New Potential High-Temperature Phase Change Materials for Latent Heat Storagee †

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Abstract: This work examines the thermal stability testing results of Mg84Cu16 as a new phase change material for its potential use in latent thermal energy storage systems for 488 °C transition temperatures. The results obtained in a previous study [1,2] showed that the Mg84-Cu16 alloy is one the most promising materials for thermal energy storage applications due to their eutectic nature and because the highest thermal conductivity (106 W/mK) was reported in the 400–550 °C temperature range. To confirm these results, the thermal stability of this alloy and its behavior with container materials during its use in industrial conditions were evaluated. In the first part, the Mg84-Cu16, with latent heat of 232 J/g, was subjected to short-term thermal cycling tests in 30 melting/solidification cycles in order to identify any potential changes in their thermophysical and structural properties. Variations in thermophysical properties were analyzed using the DSC technique. The evolution of the eutectic microstructure was examined via SEM. The second part of this study studies the compatibility between the selected materiel and the different containment materials, such as SS304, SS316, and INCONEL, in order to identify the most suitable stainless steels that can be used in the construction of thermal energy storage unit for the Mg84Cu16 alloy.

Keywords: thermal cycling; thermal energy storage (TES); eutectic metal alloy; thermophysical proprieties

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