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Corrosion rate of container materials with organic phase change materials used for solar heat storage applications

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ABSTRACT

The compatibility of container materials with the phase change materials (PCMs) plays a key role in terms of economic feasibility and long term performance of the PCM integrated thermal energy storage system. In this work, compatibility of two commonly used metals (Aluminum and stainless steel) with three selected organic PCMs suitable for low temperature heat storage applications is examined based on the immersion corrosion experiment. The organic PCMs investigated are palmitic acid, paraffin wax and lauric acid with melting point temperatures between 40 to 65˚C. The mass loss and corrosion rate of the selected metal are measured after the 60 days of immersion in the three selected PCMs at 70˚C. Gravimetric analysis and microscopic investigations are also carried out for the immersion corrosion experiments. Based on these results, the influence of corrosion rate on the aluminum and stainless steel are provided and described in conjunction with the recommendations for selected metals use in thermal energy storage system. Among the metals investigated, stainless steel showed better compatibility with the selected PCMs and can be employed for long term thermal energy storage applications.

Keywords: Phase change materials; Corrosion rate; Compatibility; Immersion corrosion test.