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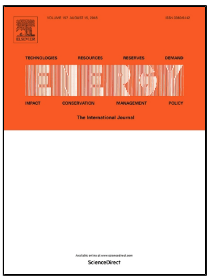

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Preparation and investigation of multicomponent alkali nitrate/nitrite salts for low temperature thermal energy storage

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Abstract: A novel eutectic salt of alkali nitrate/nitrite mixture with low melting point was investigated using thermal analysis methods for thermal energy storage. The eutectic salt mixture system $LiNO_3$-$NaNO_3$-KNO_3-$NaNO_2$-KNO_2 was prepared based on eutectic composition X_{LiNO3}=33.5, X_{NaNO3}=1.2, X_{KNO3}=1.2, X_{NaNO2}=17.4 and X_{KNO2}=46.7 (in mole fraction). Using Differential Scanning Calorimetry (DSC) apparatus, the melting point, enthalpy of fusion and specific heat capacity of the eutectic salt mixture were experimentally determined under an argon atmosphere. The density of eutectic salt mixture based on Archimedean principle was measured as a function of temperature. By means of the Thermogravimetric Analyzer (TGA) equipment, the decomposition temperature and the upper limit of operating temperature of eutectic salt mixture were determined. Viscosity of eutectic salt was also measured experimentally using a rotational coaxial cylinder viscometer constructed. Meanwhile, the empirical estimation method based on additive principle was used to predict thermal-physical properties (density and viscosity) of eutectic salt mixture. Results indicate that the predicted values were in good agreement with experiment values. Based on the thermal-physical properties of eutectic salt mixture, this novel five-component eutectic system can be used as excellent heat transfer and storage materials for low temperature thermal energy storage (TES) applications.

Keywords: Thermal energy storage; Low temperature; Molten salts; Thermal-physical properties

1 Introduction

In recent years, the consumption of non-renewable resources, such as crude oil and coal, has grown continuously with the decrease of the non-renewable resources. Furthermore, Carbon

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