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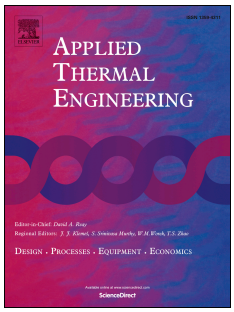

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Thermal conductivity measurement of thermochemical storage materials

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Abstract

Thermal properties related to heat and mass transfer are crucial when designing thermochemical heat storage systems. Therefore, enhancing this phenomenon lies in the thermal conductivity of the used material. The effective thermal conductivity of salt hydrates and host matrices is measured using two different methods by differential scanning calorimeter from 100 to 200 °C and radial flow apparatus called guarded hot cartridge from 20 to 70 °C, where the method effect is less than 12%. On this latter, the results as function of temperature was modelled and theoretical correlation of effective thermal conductivity of the material bed presented. Four inorganic salts often used in thermochemical energy storage ($CaCl_2$, $MgCl_2$, Sr_2Br_2 and $MgSO_4$) and host matrices (activated carbon, expanded natural graphite and silica gel) were used as samples and the results on both system for only salts give a thermal conductivity in the range of 0.3 – 1.3 $W \cdot m^{-1} \cdot K^{-1}$ with uncertainty less than 14%. These obtained data are satisfactory with literature values. Regarding the results, the need of composite design is a must to achieve great thermal performances in thermal storage systems, especially in closed systems. The presented results can be used for the evaluation and the improvement of heat and mass transfer in thermochemical and sorption storage systems.

Keywords : Thermal conductivity; Salt hydrates; Porous material; DSC, Guarded hot cartridge; Energy storage.

1. Introduction

In thermal engineering where thermal transport is always involved, scientists or engineers have to manage or to know the thermal properties of the used materials in order to design or choose an