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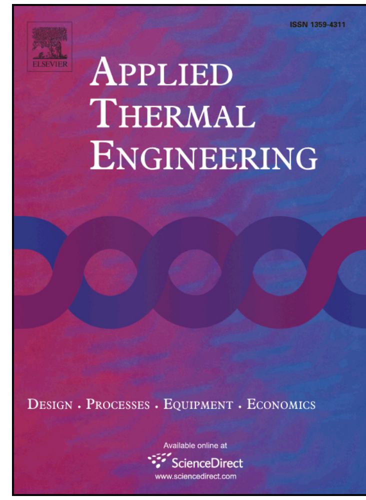

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Effect of kinetics on the Thermal Performance of a Sorption Heat Storage Reactor

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Abstract

To reach high solar fractions for solar thermal energy in the built environment, long-term heat storage is required to overcome the seasonal mismatch. A promising method for long term heat storage is to use thermochemical materials, TCMs. In this research, a lab-scale test thermochemical heat storage system is tested experimentally and modeled numerically. Water-zeolite 13X is used as the working pair in an open packed bed reactor. The purpose of this study is to understand the effects of the kinetic parameters for the adsorption of water vapor on Zeolite 13X (2mm spherical beads), on the thermal performance of a sorption heat storage packed bed reactor. A mathematical model is developed incorporating the kinetics model and the isotherm curves and including the heat losses from the side wall of the reactor, and is validated by comparing the calculated temperature profiles with experimental ones from a lab-scale test setup. The numerical and experimental results are used to calculate the heat fluxes in the reactor and are compared to evaluate the thermal performance of the reactor. With the validated model, a parameter study is carried out into the effect of the reaction kinetics and the gas flow rate on thermal performance of a thermochemical heat storage reactor under full scale normal operating conditions. From this work, predictions of the thermal dynamics of an adsorption bed

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