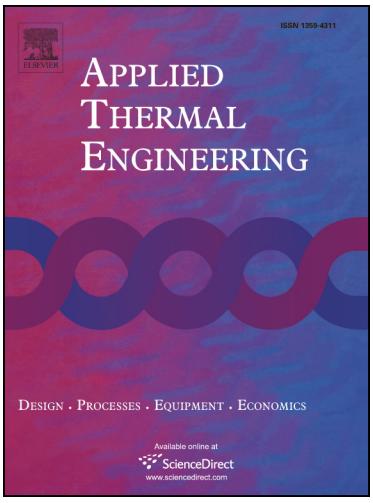

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Numerical study of high temperature metal-hydrogen reactor (Mg_2Ni-H_2) with heat reaction recovery using phase-change material during desorption

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Abstract

High temperature metal hydrides used for storing hydrogen have promising future prospect due to the interesting density that characterizes it. This type of hydride offers high hydrogen storage capacities and its formation is highly exothermic. Therefore, the formation enthalpy represents 30 % of the lower heating value (LHV) of the absorbed hydrogen, which represents a significant energy cost.

This article introduces a numerical study of a new cylindrical conception of a high temperature metal-hydrogen reactor (MHR) integrating a phase change material (PCM). This system was developed to store efficiently the realized heat during hydrogen absorption process in order to recover it during desorption. A mathematical model was developed in two-dimensional (2D) and solved using the unstructured control volume finite element method (CVFEM). For this model, the proposed expressions of the reaction kinetic and the equilibrium pressure of the hydride system (Mg_2NiH_4) [1] and the analytic approximation based on the Heaviside step function [2] to describe the liquid fraction were used to simulate