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Transient simulation studies on a metal hydride based hydrogen storage reactor with longitudinal fins

Mahvash Afzal [b], Nitin Sharma [a], Nandlal Gupta [a], Pratibha Sharma [a]

[a] Indian Institute of Technology Bombay, Mumbai, India

[b] Islamic University of Science and Technology, Kashmir, J&K, India

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Abstract

In this study, a 50kg $LaNi_5$ based shell and tube type metal hydride hydrogen storage reactor is investigated. The design process for the reactor is presented and its performance analysis is carried out numerically. The metal hydride is filled in the tubes while the shell side houses the heat transfer fluid. Each of the metal hydride tubes is equipped with fins connected to a longitudinal array of concentric cylinders for support and for ensuring uniform distribution of alloy powder, which is a challenge in case of large reactors. The number of tubes MH tubes which is seven in the present case was selected on the basis of highest heat transfer capacity per unit system weight. The reactor performance was simulated under varying operating conditions. It was observed that reactor performance was quiet promising at a moderate supply pressure of 35bar and a heat transfer fluid flow rate of as low as 30lpm. Any increase in flow rate does not alter the reactor performance significantly. Initial bed temperature did not have any significant effect on the system performance. Thermal resistance network analysis established that heat transfer was primarily limited by conduction.