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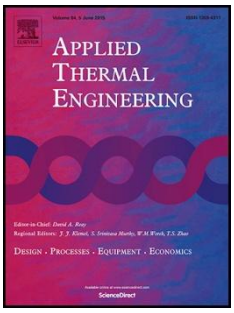

Title: Parametric investigations on compressor-driven metal hydride based cooling system

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Parametric Investigations on Compressor-Driven Metal Hydride Based Cooling System

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Highlights

- Prototype of a CDMHCS has been tested for different operating conditions.
- Effects of operating temperatures on COP and SCP have been studied.
- Variation in hydride bed temperature during cyclic operation has been presented.
- Effectiveness of the hydride reactor analysis has been studied.

Abstract

In this manuscript, the development of a compressor-driven metal hydride based cooling system (CDMHCS) employing two identical metal hydride reactors each embedded with 60 cooling tubes, filled with 2.75 kg of $LmNi_{4.91}Sn_{0.15}$ hydride alloy for quasi-continuous cold generation is presented. Performances of the CDMHCS in terms Coefficient of Performance (COP) and Specific Cooling Power (SCP) along with the amount of hydrogen (H_2) transferred in each cycle have been investigated at different refrigeration and sink temperatures, cold fluid flow rates and cycle times. The maximum COP and SCP of 2.2 and 53.5 W/kg respectively were observed for a cycle time of 8 min at cold fluid flow rate of 8 lpm, refrigeration and sink temperatures of 20 °C and 25 °C respectively. It was observed that COP and SCP of the system improved significantly with increase in refrigeration temperature, however they decreased with increase in sink temperature.

Keywords: Metal hydride; hydrogen energy; compressor driven cooling system; performance test; specific cooling power.

Nomenclature

Cp	specific heat capacity, kJ/kg °C
Em	energy meter reading, kWh
ΔH_d	molar enthalpy of formation during desorption process, kJ/mol
m_a	total alloy mass, kg
$\dot{m}$	mass flow rate, kg/s
N	number of moles of hydrogen transferred, mol
Q_{cold}	net cooling effect, kW