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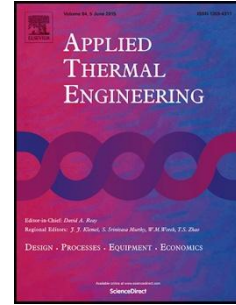
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Author: P. Muthukumar, Manojkumar S Patil, R. Nithin Narmada, Mohd Imran

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# Parametric Investigations on Compressor-Driven Metal Hydride Based Cooling System

P. Muthukumar\*, Manojkumar S Patil, R. Nithin Narmada, Mohd Imran

Department of Mechanical Engineering, Indian Institute of Technology Guwahati, Guwahati,  
Assam, India.

\*Corresponding author: Tel.: +91 361 2582673; Fax: +91 361 2690762 E-mail:

pmkumar@iitg.ernet.in; pmuthukumar@yahoo.com

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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.
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## 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  $\text{LmNi}_{4.91}\text{Sn}_{0.15}$  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 ( $\text{H}_2$ ) 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.

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## Nomenclature

$C_p$	specific heat capacity, kJ/kg °C
$E_m$	energy meter reading, kWh
$\Delta H_d$	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
$Q_{\text{cold}}$	net cooling effect, kW

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