National Institute of Technology Rourkela

Registration Seminar

Seminar Title	: Development and Implementation of Metal Hydride Canisters for Energy Storage Systems
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Venue	: ME Seminar Hall [ME001]
Date and Time	: 16 May 2025 (11.00 AM)
Abstract	: The research's unequivocal target is to decrease the system's weight without sacrificing absorption time and extraction rate. The optimal design is selected based on a combinational evaluation of three responses by assigning equal weightage through the desirability technique. The optimal canister design comprised 6 and 4 mm outer and inner diameters, a pitch of 20 mm, and a coil placement configuration 3 (the distance between the second coil&rsquos outer diameter and the shell's inner diameter was kept at 2.4 mm). Under operating conditions of 15 bar pressure, 298 K coolant temperature, and 3 lpm water flow, the optimized design attained the highest weight ratio of 2.4, specific heat extraction rate of 1389.12 $kW/kg_h \cdot m^3$, and hydrogen absorption within 251 s. Followed that, fabrication of two identical novel lightweight canisters that can hold 10 kg of AB_5-alloy (assuming 20% free volume for expansion) is explicitly developed for zero-emission heat and energy storage applications. In the constructed canister, a 6.35 × 5.35 mm copper tube is used instead of a 6 × 4 mm copper tube to increase the weight ratio marginally (&uarr11.76%). Two identical twin-helical coiled canisters were fabricated, with one featuring a 10&ndash15 micron copper coating on the inner and outer shell surfaces to examine the enhancement in thermal performance attributable to the copper coating. The fabricated canisters recorded a 5.4 and 5.5 kg weight for the non-coated and coated ones, respectively. Considering a 10 kg filling of AB_5-alloy, the canisters account for a weight ratio of 1.85 and 1.82, the lightweight metal hydride-based hydrogen storage canisters reported to be so far.