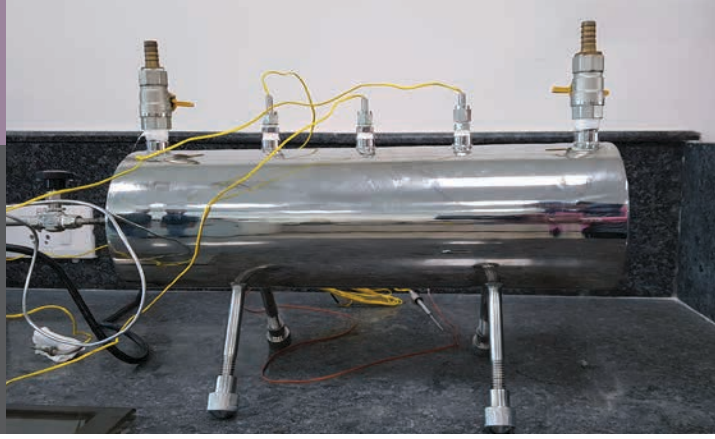
100 kWh Solid-State Hydrogen Storage Device



Problem Statement: Hydrogen storage is the biggest bottleneck in the large-scale usage of hydrogen. Currently, compressed hydrogen is transported in pressurised vessels, whether for vehicular applications or short-distance transport. The pressure is high, ranging from 350 bar to 700 bar. Liquid state storage requires a temperature of 20K (-253°C) and thus needs super-insulated tanks. However, the solid-state storage can be done under normal operating conditions, that is, near room temperature and from 1 bar to around 30 bar pressure. Solid-state hydrogen storage is advantageous because it has high volumetric energy density near ambient operation conditions (temperature and pressure). However, when metal hydrides are used for storage, the hydrogenation and dehydrogenation reactions are exothermic and endothermic, respectively. Thus the device/reactors used for metal hydride based solid-state hydrogen storage should be designed to consider the thermal management to supply/remove the heat required/generated during these processes.

Uniqueness of the Solution: The team simulated solid-state hydrogen storage devices and computationally optimised them to get the best performing designs. They adopted several methodologies to get the optimum device configuration. They fabricated the devices and studied them experimentally for cycling and performance analysis.

Current Status of Technology: The team has simulated, optimised and then developed several such solid-state hydrogen storage devices in the laboratory. In addition, they have demonstrated reactors of different sizes like 10 kWh, 30 kWh and 100 kWh, and their applicability for various applications.

Societal Impact: Compressed hydrogen tanks for hydrogen storage are currently being imported and are very expensive. The devices that the team has developed in the laboratory can be used for various applications such as vehicular applications, heating and cooling, backup power, hydrogen compression, hydrogen purification and thermal energy storage. In addition, these devices can be scaled up for various other application requirements.

Patent(s): Filed & Granted

Relevant Industries: Energy, Automobiles, Hydrogen Storage, Forklifts or Stationary Applications.

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