

The U.S. national hydrogen storage project: meeting the challenge of vehicular hydrogen storage

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Abstract

An effective and low cost method to store hydrogen is one of the key requirements to enable the widespread commercialization of hydrogen and fuel cell technologies. In the transportation sector, hydrogen-powered vehicles require a driving range of more than 300 miles in order to meet customer requirements in the North American market and to compete effectively with other automotive technologies. Achieving such a driving distance requires that approximately 5 to 13 kg of hydrogen be stored on-board the vehicle to cover the overall light duty vehicle fleet. Storage of these quantities of hydrogen within vehicular weight, volume, safety, and system cost constraints is a significant scientific and technological challenge. While some vehicles may achieve a driving range of more than 300 miles in the near term using high pressure tanks, a more effective means of storage is required for mass market penetration across all vehicle platforms and without compromising performance and space on-board the vehicle.

Vehicular hydrogen storage targets have been established in the United States through the FreedomCAR & Fuel Partnership, a partnership among the Department of Energy (DOE), the U.S. Council for Automotive Research and major energy companies. These targets have provided specific technical metrics to the global research community by translating system driven performance requirements into tangible goals such as system capacity, cost, durability and charging/discharging rates. The National Hydrogen Storage Project has been initiated by the DOE to meet these targets. Centers of Excellence in metal hydrides, chemical hydrogen storage, and hydrogen sorption have been established, each Center involving a number of university, industry, and federal laboratory partners. In addition, independent university and industry projects are being supported in the areas of new concepts/materials, hydrogen storage testing, and storage systems analyses. Recent progress achieved in hydrogen storage through the R&D activities of The National Hydrogen Storage Project will be highlighted and discussed. In addition to materials development, cross cutting topics of independent testing, systems analysis and material reactivity will be presented. The current status of hydrogen storage with respect to targets and future plans will be summarized.