The U.S. Department of Energy's National Hydrogen Storage Project: Goals, Progress and Future Plans

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On-board vehicular hydrogen storage is considered to be one of the most challenging technical barriers to the widespread commercialization and market acceptance of hydrogen-powered vehicles. In the North American market consumers demand a driving range of more than 300 miles without compromising performance or useable space in the vehicle. Based on this goal, vehicular hydrogen storage targets have been established through the FreedomCAR & Fuel Partnership, a partnership between the DOE, the U.S. Council for Automotive Research and major energy companies. To accelerate R&D efforts aimed at meeting these targets, DOE launched a Grand Challenge to the scientific community to develop a "National Hydrogen Storage Project" and established Centers of Excellence in metal hydrides, chemical hydrogen storage, and sorbent-based materials in 2005, each 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 for a total of about 40 universities, 15 companies and 10 federal laboratories.

Technical requirements and current status of various technologies will be presented as well as R&D needs, including nanotechnology approaches applied to hydrogen storage. The majority of R&D is focused on high capacity materials that typically have intrinsic thermodynamic properties (e.g., enthalpy of formation, operating temperature, stability, reversibility) or kinetic properties (e.g., absorption, desorption rates) that render them unsuitable for direct use in storage systems. Thus, research efforts are directed at searching for new storage materials, improving the performance of storage materials through alloying, using catalysts and nano or meso-scale structural modifications, and examining alternate reaction pathways to overcome thermodynamic barriers. Recent progress achieved in hydrogen storage through the R&D activities of The National Hydrogen Storage Project will be highlighted, as will examples of international collaborations, such as through the International Partnership for the Hydrogen Economy (IPHE). Key research needs and future plans will also be presented.