



Pacific Northwest National Laboratory

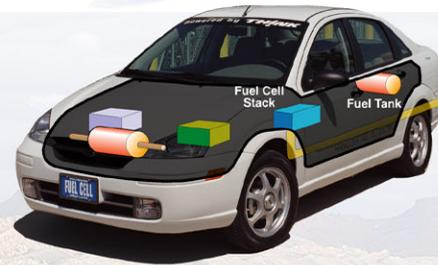
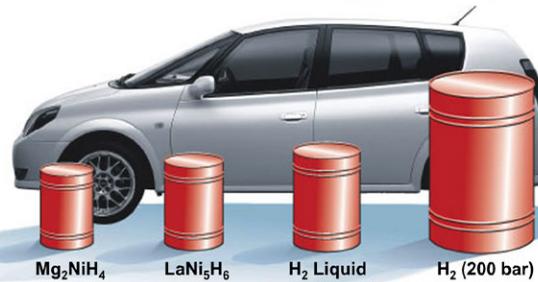
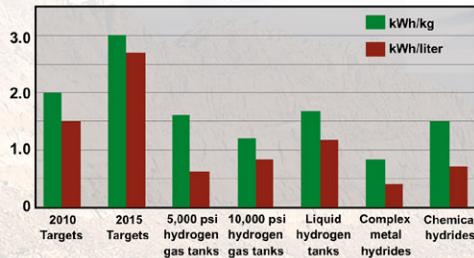
Operated by Battelle for the U.S. Department of Energy

Hydrogen Storage—A Critical Challenge to the Hydrogen Economy

Department of Energy Hydrogen Storage Goals

- 2010 goals: 2 kWh/kg (6 wt%), 1.5 kWh/L and \$4/kWh
- 2015 goals: 3 kWh/kg (9 wt%), 2.7 kWh/L and \$2/kWh

Currently Possible



PNNL's Unique Capabilities for Developing Hydrogen Storage Materials



- **Computational chemistry and modeling**
 - New 11.4 teraflop supercomputer
 - Broad computational capabilities ranging from first principle to thermodynamic stability calculations
 - Computational software developed and distributed for broad use



- **Processes to accelerate reaction kinetics**
 - Catalyst development
 - Microchannel reformer technology
- **Environmental Molecular Science Laboratory, a national user facility with cutting-edge equipment**
 - Solid-state NMR
 - Molecular beam surface scattering
 - Analytical chemistry and surface analysis tools



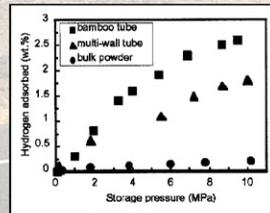
Hydrogen Storage Concepts

Compressed and Liquified H₂

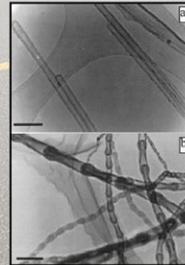


All composite tanks available with 5,000 psi (350 bar) capacity. Higher pressure tanks being developed.

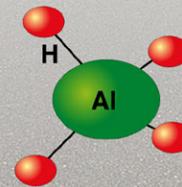
Hydrogen Storage in Boron Nitride Nanotubes



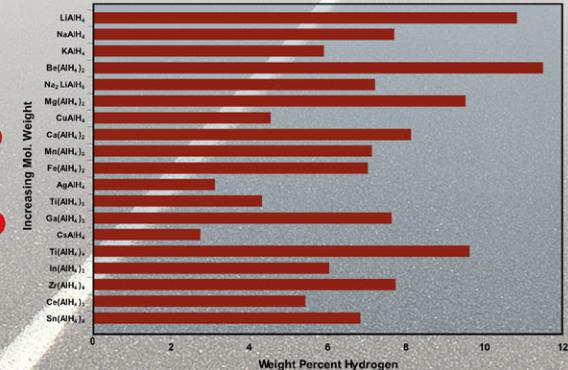
Carbon or Boron Nitride Nanotube Storage



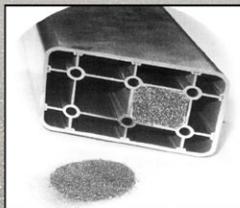
Complex Hydrides



On-Board Hydrogen Storage



Reversible Complex Hydride Storage System



Sodium alanate doped with titanium is a reversible material hydrogen storage approach.

Chemical Hydrides

