

- 1 *Mg-Ni flakes for high-density hydrogen storage*
- 2 *MgH₂-graphite composite (blue-red) with optimized heat transfer properties*
- 3 *Pelletized hydride-carbon materials for high-density hydrogen storage*

HYDROGEN STORAGE MATERIALS ENGINEERING AND TESTING

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Hydrogen as Energy Carrier

Hydrogen is an environmentally friendly and powerful energy carrier which can be used in fuel cells or internal combustion engines.

The safe, efficient and reliable storage of hydrogen is an important element in a hydrogen-based energy cycle. Hydrogen can be stored rapidly and very compactly through a chemical reaction with various metal alloys whereby metal hydrides are formed.

At Fraunhofer IFAM Dresden, hydrogen storage materials are prepared and can be tested thoroughly (hydrogen storage capacity, reaction kinetics, reaction heat transfer, cyclability, degradation). Furthermore, the hydrogen laboratory provides the opportunity to test and evaluate hydrogen storage materials in designed tanks or cartridges under realistic operation conditions.



Applications of Metal Hydrides

- Hydrogen storage
- Hydrogen purification (7.0 and better)
- Hydrogen gettering
- Hydrogen separation from gas mixtures
- Thermochemical devices:
 - Compressors for H₂
 - Heat pumps for cooling, heating or both
 - Thermoboosters for fast heating
 - Heat storage



Hydride Classes

- Low-temperature hydrides
-20°C ... 80°C,
e.g. Zr-Mn, La-Ni, Ti-Mn, Fe-Ti alloys
- Medium-temperature hydrides
80°C ... 200°C,
e.g. LiAlH₄, NaAlH₄, LiNH₂
- High-temperature hydrides
200°C ... 400°C,
e.g. various Mg alloys



- 4 Hydride storage tank with active thermal management
- 5 Test rig for hydride tank testing
- 6 Flow and pressure control devices

R&D Services

For individual customer needs, Fraunhofer IFAM Dresden develops and tests materials, technologies and systems in the following fields:

- Synthesis and manufacturing of hydrogen storage materials
- Materials design regarding:
 - Storage density
 - Kinetics
 - Heat transfer properties
 - Cycle stability
- Testing and evaluation of hydride materials
- Development and testing of materials processing technologies
- Design and construction of hydride tanks and cartridges
- Simulation of hydrogen loading and unloading processes in hydride-based storage tanks
- Reliability tests of hydride tanks
- System integration of hydrogen storage tanks with
 - Electrolysers
 - H₂ fuel cells
 - H₂ internal combustion engines
- System development and testing of hydride-based thermochemical devices:
 - Compressors for H₂
 - Heat storage systems
 - Thermoboosters
 - Cooling devices
 - Thermochemico-mechanical actuators

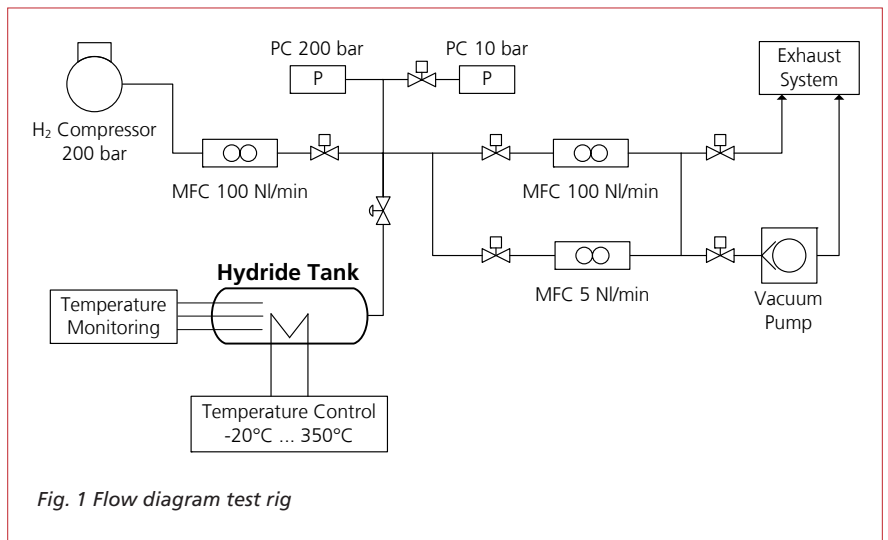


Fig. 1 Flow diagram test rig

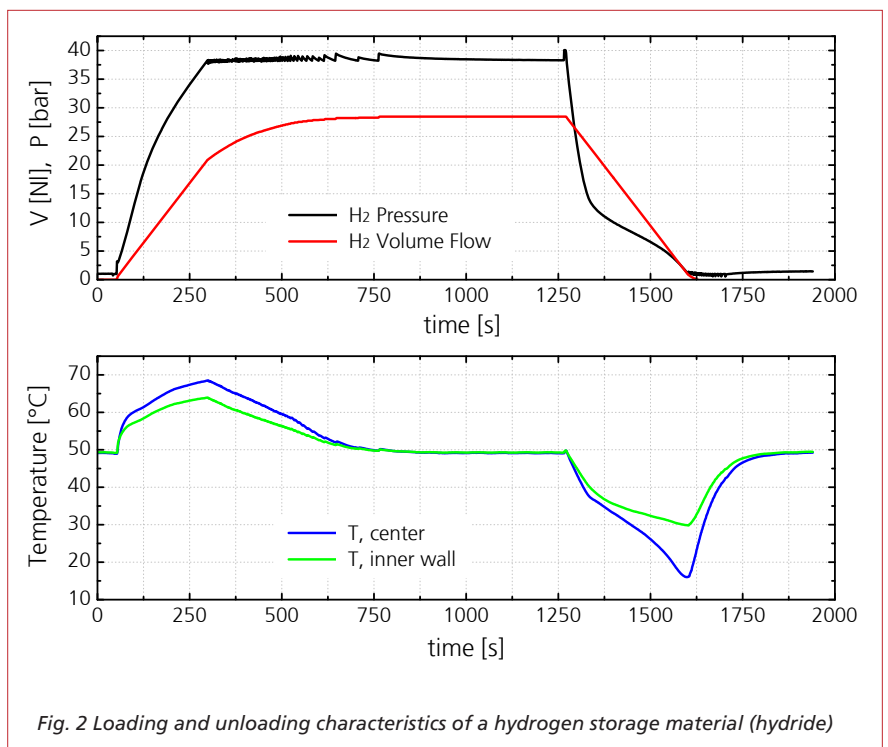


Fig. 2 Loading and unloading characteristics of a hydrogen storage material (hydride)