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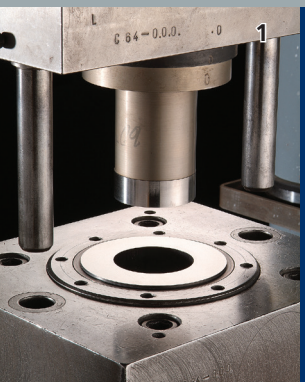
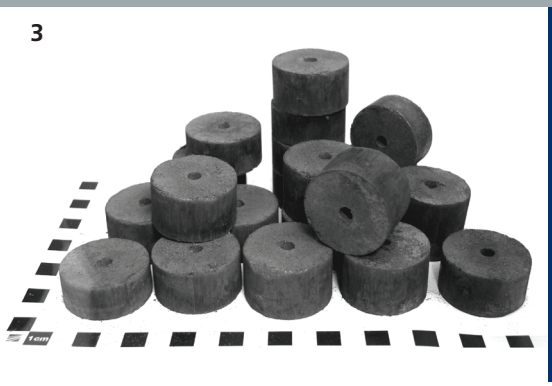
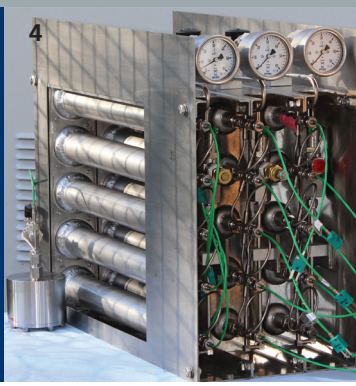






1 *Uniaxial press for the production of metal hydride composites*
2 *Cross-section of a metal hydride composite with optimized heat transfer properties*
3 *Metal hydride composites for high-density hydrogen storage*
4 *Metal hydride storage tank for stationary fuel cell power systems*

Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM Branch Lab Dresden
Winterbergstrasse 28
01277 Dresden I Germany

Contact

Dr. rer. nat. Lars Röntzsch
Phone: +49 351 2537 411
E-Mail: Lars.Roentzsch
@ifam-dd.fraunhofer.de

Dipl.-Ing. Felix Heubner
Phone: +49 351 2537 570
E-Mail: Felix.Heubner
@ifam-dd.fraunhofer.de

Fax +49 351 2537 399

www.ifam.fraunhofer.de/en/h2

METAL HYDRIDE TECHNOLOGY

LOW PRESSURE HYDROGEN STORAGE

Metal Hydrides

Hydrogen can be safely stored in a very compact form and at low pressure through a chemical reaction with a hydrogen-absorbing alloy: A solid metal hydride is formed (Fig. 1).
Fraunhofer IFAM designs, produces and characterizes hydrogen storage materials according to customer requirements using state-of-the-art methods.
In addition, we provide engineering services for the design, construction, and testing of metal hydride storage tanks and other metal hydride-based systems, including integration into fuel cell power systems (Fig. 2).

Applications

- Hydrogen storage
- Hydrogen purification (7.0 and better)
- D_2 / H_2 separation
- Hydrogen gettering
- Hydrogen separation from gas mixtures
- Thermochemical devices

Metal Hydrides Made at Fraunhofer IFAM

- Based on transition metal alloys, e.g. Fe-Ti, Zr-Mn, La-Ni or Ti-Mn
- Complex hydrides (including dopants), e.g. $LiAlH_4$, $NaAlH_4$ or $LiNH_2$
- Based on lightweight metal alloys, e.g. Mg-Ni or Mg-RE alloys

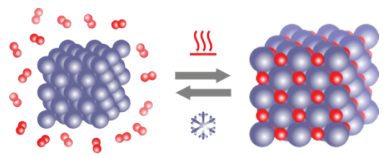


Fig. 1 Metal hydride formation (schematics)

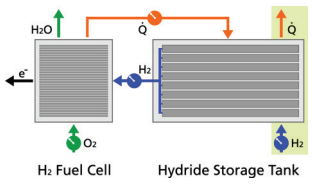
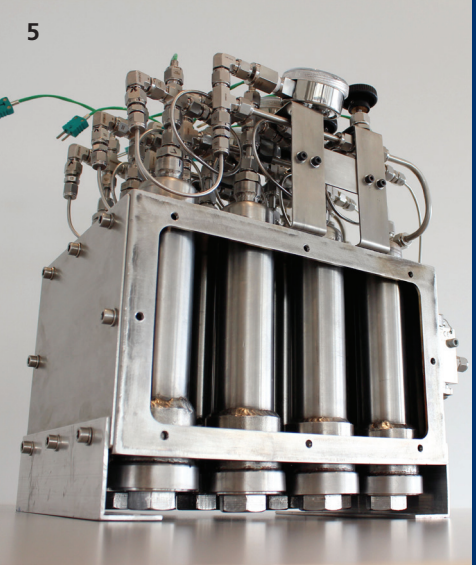
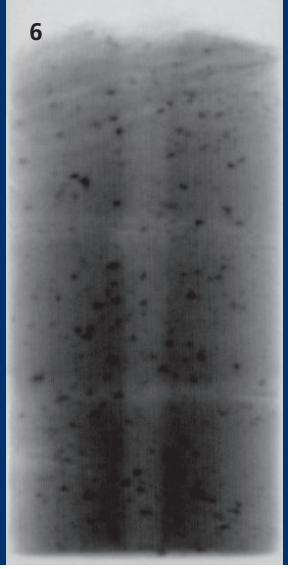


Fig. 2 Metal hydride fuel cell power system





Research and Engineering Services at Fraunhofer IFAM

- Metal hydride (MH) development and testing:
  - Storage capacity
  - Hydrogenation kinetics
  - Heat and gas transfer properties
  - Cycle stability
  - State-of-health analysis
  - Recycling
- Production of MH composites:
  - MH-metal composites
  - MH-graphite composites
  - MH-polymer composites
- Testing and evaluation of MH (in operando, post mortem)
- Development and testing of MH processing technologies
- Design and construction of MH storage tanks and MH cartridges
- Simulation of hydrogen loading and unloading processes in MH storage tanks
- Reliability tests of MH tanks
- System integration of MH storage tanks with:
  - Electrolysers
  - H_2 fuel cells
  - H_2 internal combustion engines
- System development and testing of MH-based devices:
  - H_2 compressors (vibrationless)
  - Heat pumps
  - Thermoboosters
  - D_2 / H_2 separators
  - H_2 purifiers
  - Thermomechanical actuators
  - MH gauges (filling meters)

5 Metal hydride tank for a PEM fuel cell vehicle

6 In-operando testing of metal hydride composites (here: radiography)

7 Universal testing reactor for metal hydrides (200 bar; max. 400 °C)

8 Test rig for metal hydride tank evaluation

Fig. 3 Flow diagram test rig

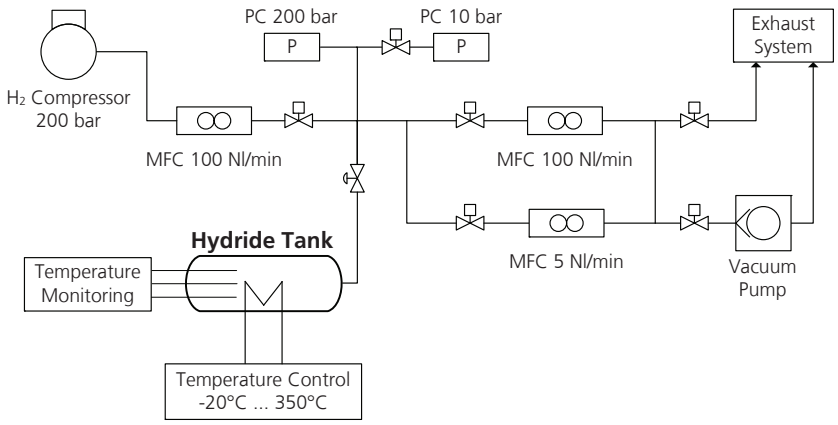


Fig. 4 Loading and unloading characteristics of a metal hydride