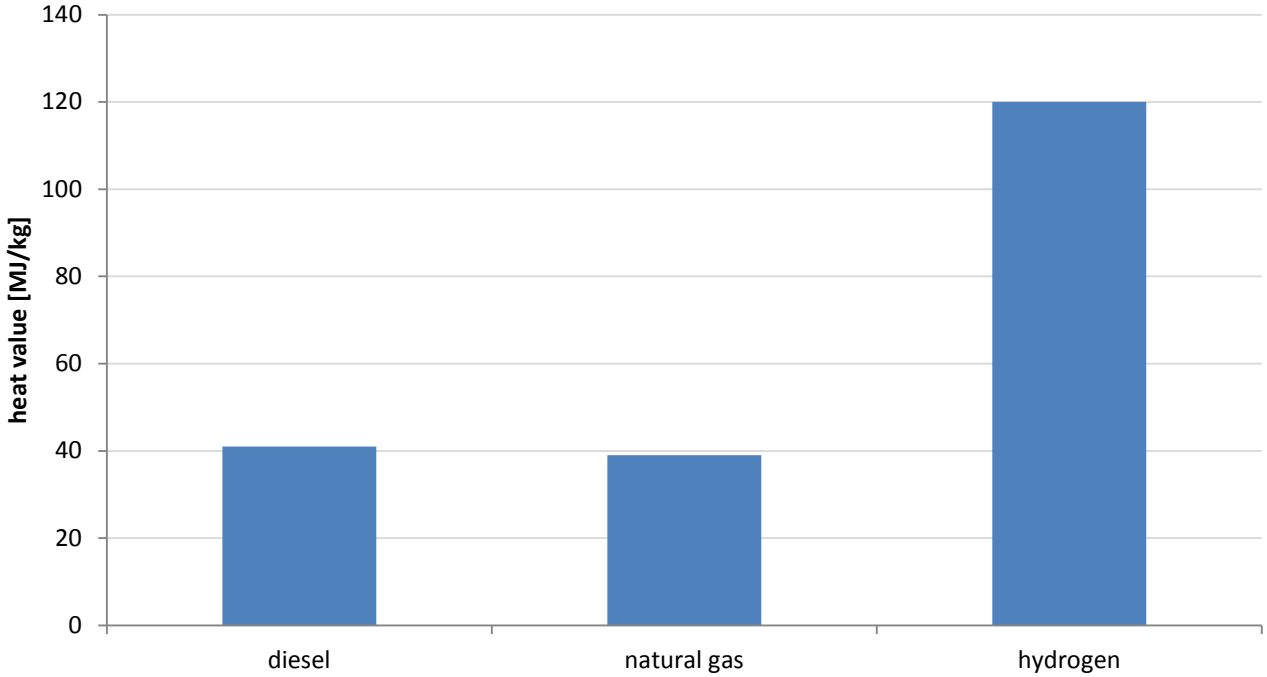

high reactive energy carrier require safe storage

High Density Hydrogen Storage in Metal Hydride Composites with Air Cooling

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In collaboration with
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DLR – German Aerospace Center

- Aeronautics
- Space Research and Technology
- Transport
- Energy

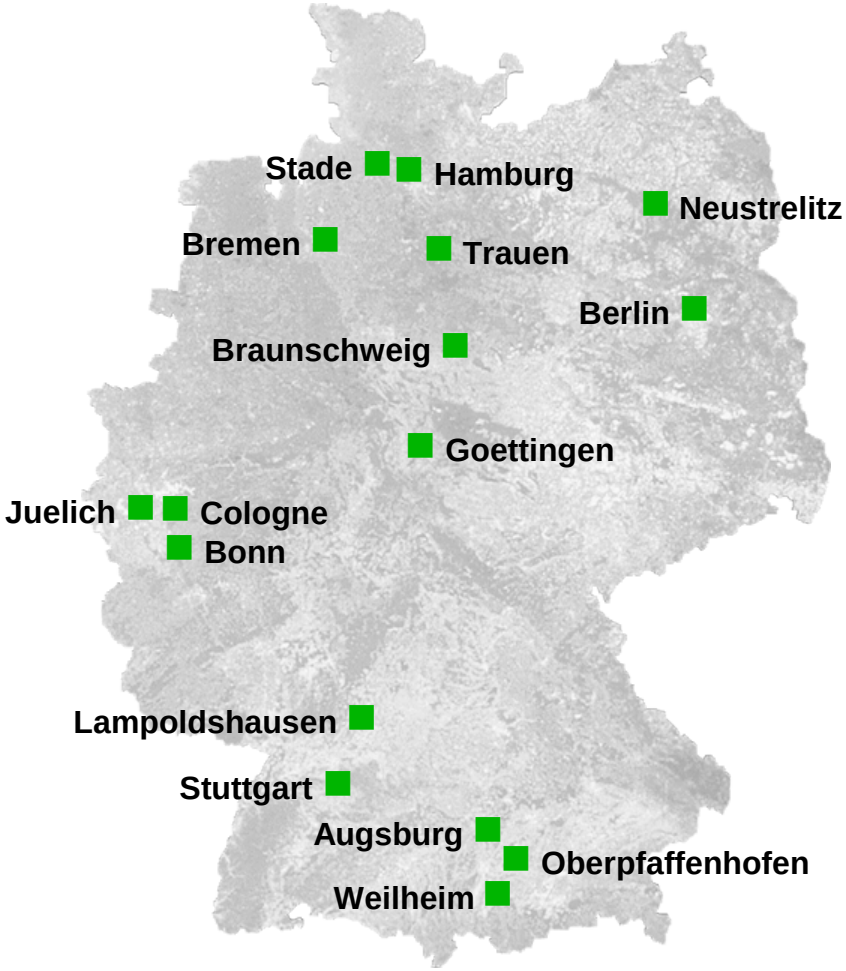
- Space Administration
- Project Management Agency

DLR

Locations and employees

7400 employees across
32 institutes and facilities at
16 sites.

Offices in Brussels,
Paris, Tokyo and Washington.



Institute of Engineering Thermodynamics

Thermal Process Technology

Dr. Antje Wörner

Thermal Energy Storage *Dr. Stefan Zunft (acting)*	**Thermal Power Plant Components** *Dr. Stefan Zunft*	**Thermochemical Systems** *Dr. Marc Linder*	**Alternative Fuels** *Dr. Uwe Dietrich*
			
Concrete Storage „Cell Flux“-Concept Salt Storage Latent Heat Storage	Regenerator Storages High Temperature Heat Exchangers	Thermochemical Storage Heat Transformation H_2-Storage	Liquid Hydrocarbon Fuels H_2-Generation and Gas Cleaning
Stuttgart, Cologne	Stuttgart	Stuttgart, Cologne	Stuttgart

DLR

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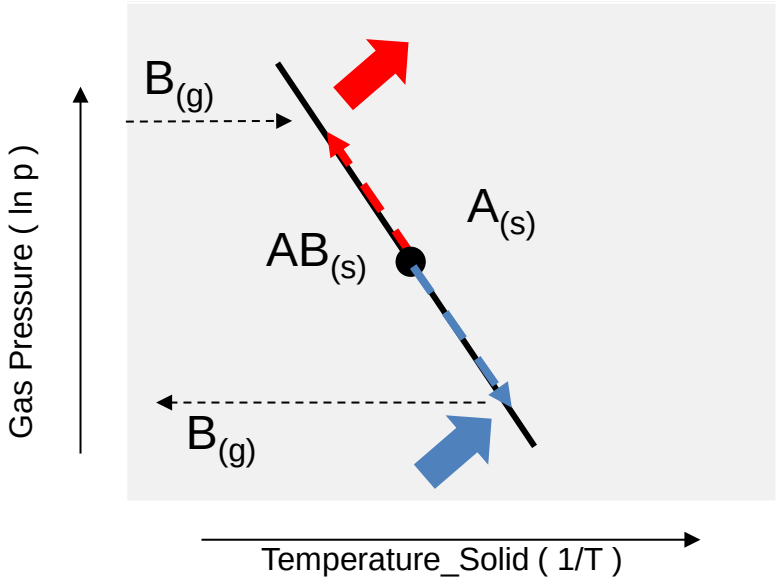
Thermochemical Systems

Reaction Principle

endothermal

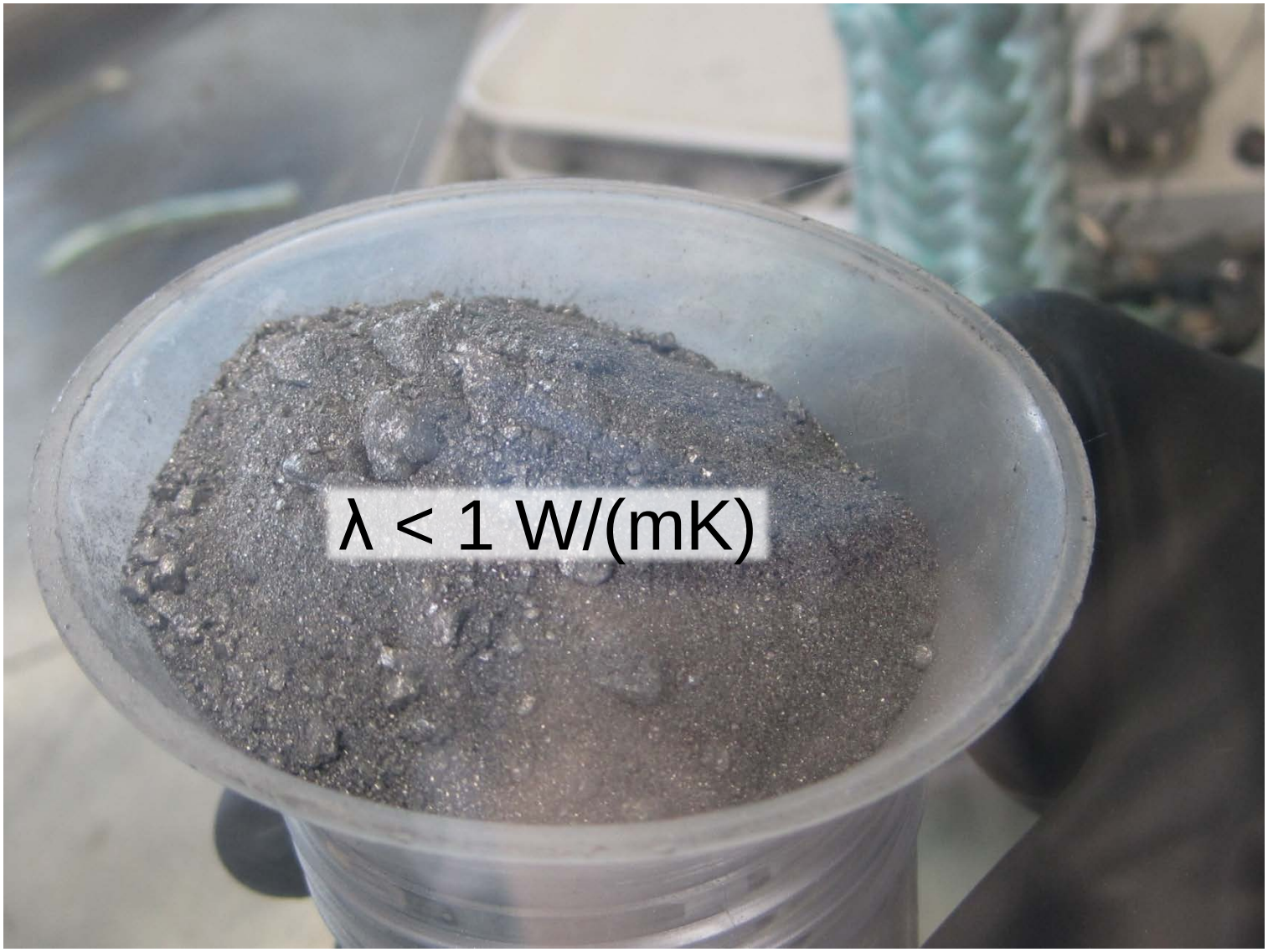
$$AB_{(s)} + \Delta H \rightleftharpoons A_{(s)} + B_{(g)}$$

exothermal



Heat released during absorption (charging)

Heat required during desorption (discharging)



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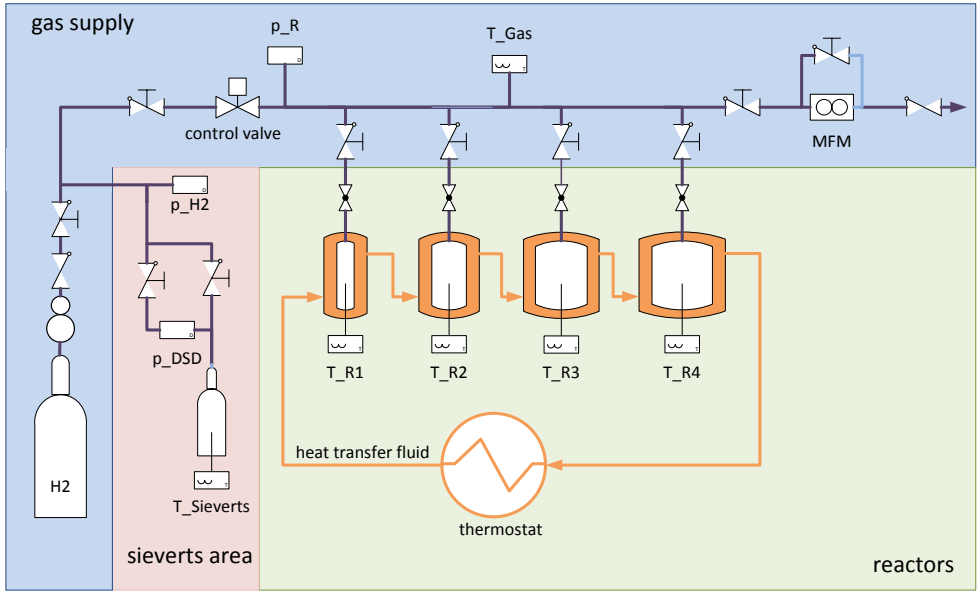
Metal Hydride-Graphite Composites

thermal conductivity in two-digit range

test rig for cycling stability investigation



⇨ composites show stability of structure and hydrogen performance for 1000 cycles (paper in review process)

High Density Hydrogen Storage

fluctuating renewable energy sources

↓

storage in form of hydrogen:

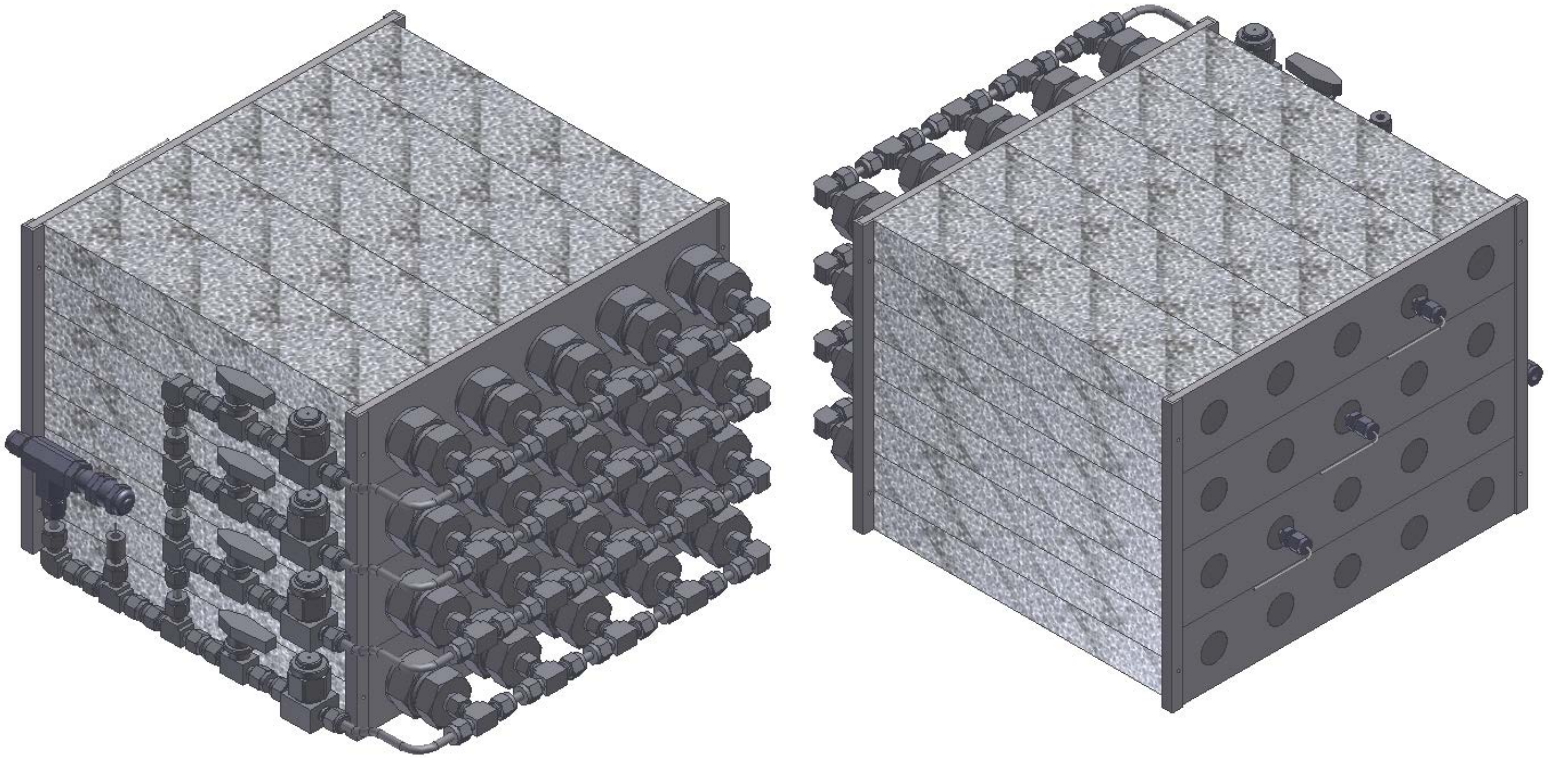
surplus electricity → electrolysis → H_2 → storage → H_2 → fuel cell → meet of energy demand

↓

- high volumetric storage density
- safe: low pressure
  moderate temperature
- low-maintainance
- simple construction

[Acta S.p.A., “Electrolysör Datenblatt EL250-500-1000”]

High Density Hydrogen Storage



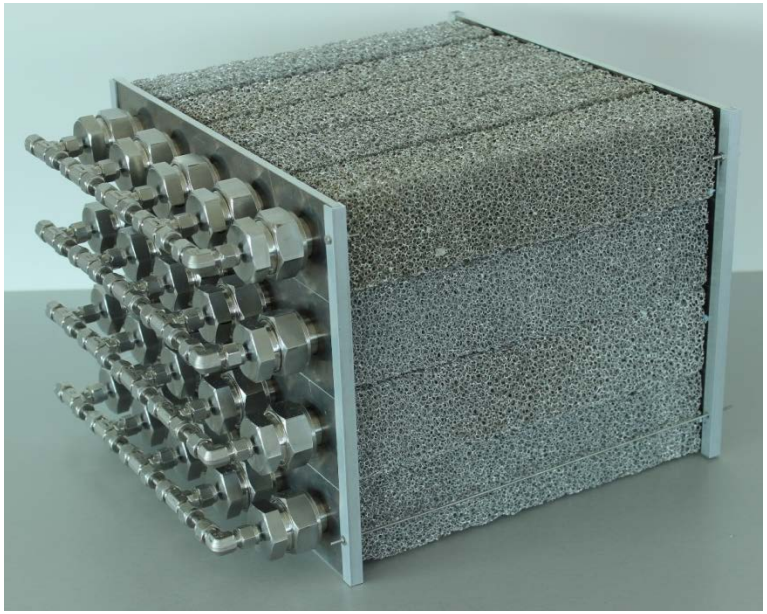
High Density Hydrogen Storage

- composite diameter: 21mm
- vantilator cooling (1.7 W_{el})

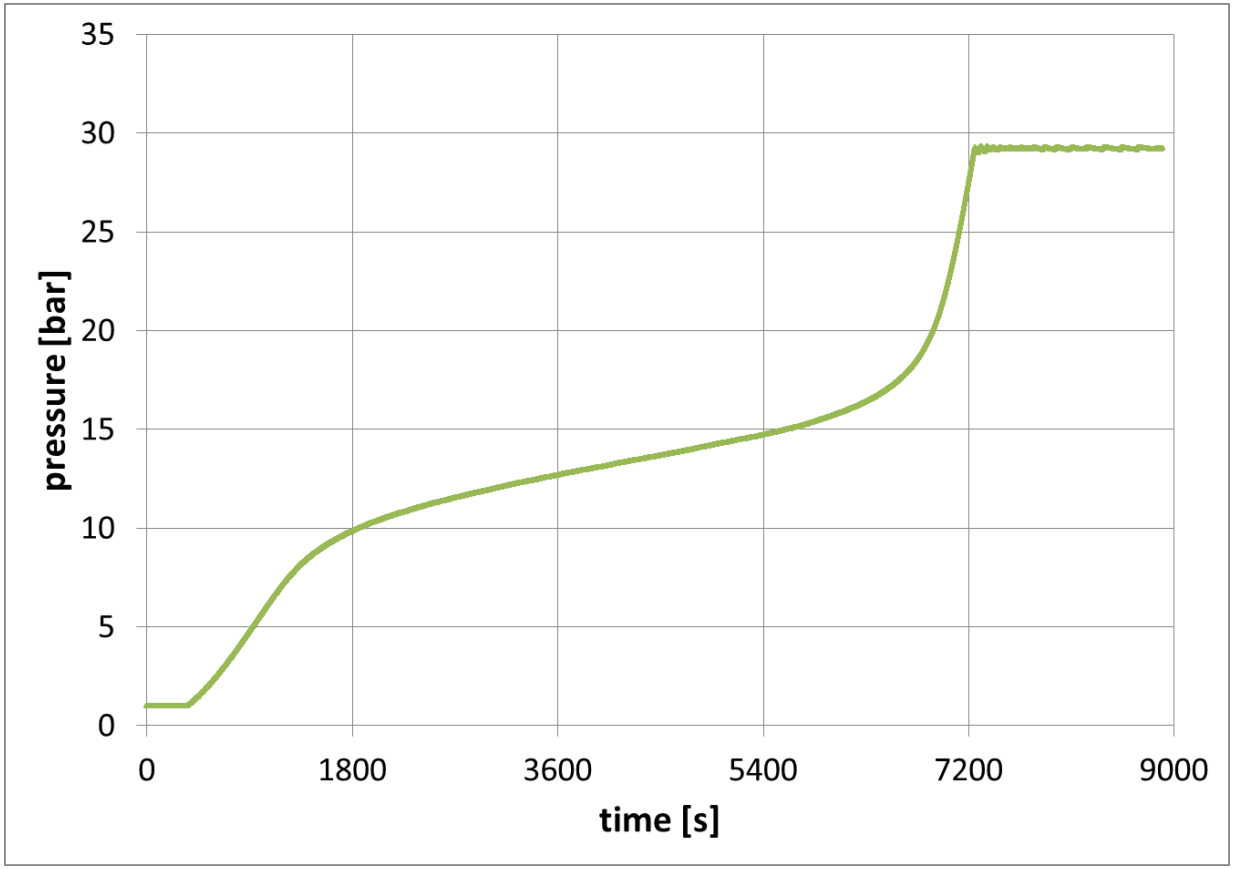
- charging with **electrolysis at 30bar**
- discharging with mass flow to

  feed FC with P_{el} = 0.6 kW for 100min

  → upscalable

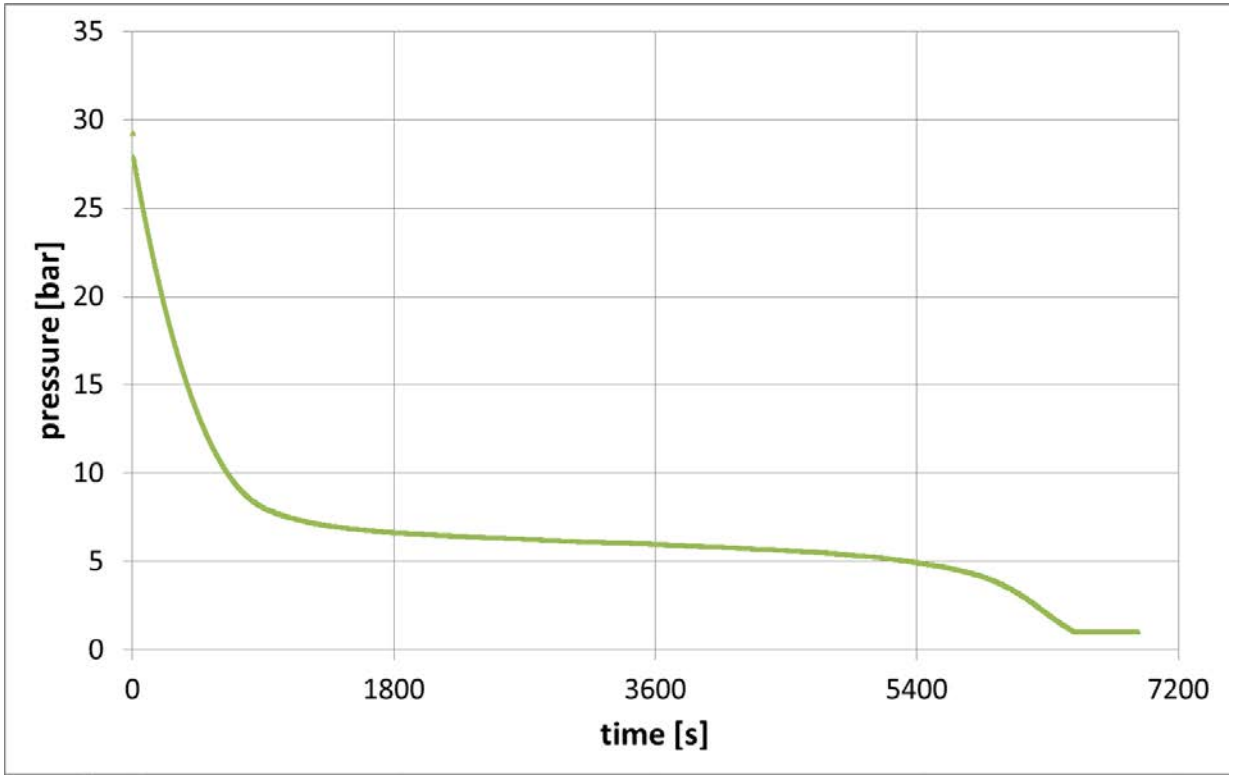


First Measurement Results – Absorption



⇨ fully charged in 2h below 30 bar

First Measurement Results – Desorption



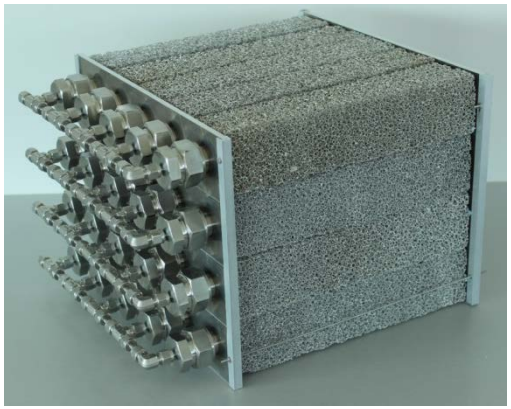
⇨ provides hydrogen for FC for more than 100min

➡ **Storage meets requirements**

Summary

- H_2-storage in metal hydrides
- long-term cycle stable composites with high thermal conductivity
- Development of simple and safe storage for domestic application
- High diamerter (21mm) with only ventilator cooling
- Charchable below 30bar (electrolysis)
- Discharable to run FC with 0.6 kW for 100min

  (power and time are upscalable)



Thank you!

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