Institute of
Technical Thermodynamics

Investigation of Long Term Cycle Stability – First Results of Metal Hydride Composites

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INTRODUCTION

Importance of Cycle Stability

Application areas of metal hydrides:
- Hydrogen storage
- Thermochemical devices
  - heat storage
  - heat conversion systems

→ all applications require high numbers of cycles

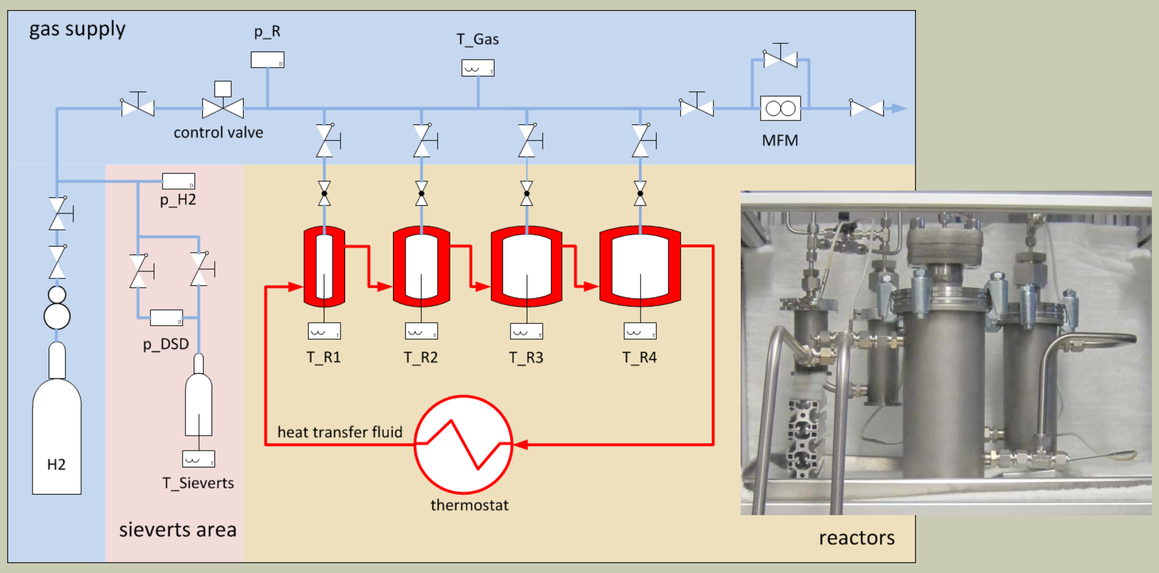
Fundamental necessity for all applications:
Cycle stability of the reaction material and - if required - its bulk structure

Test bench to investigate cycle stability of metal hydrides and composites was developed and brought into operation at DLR

PRINCIPLE & RESULTS

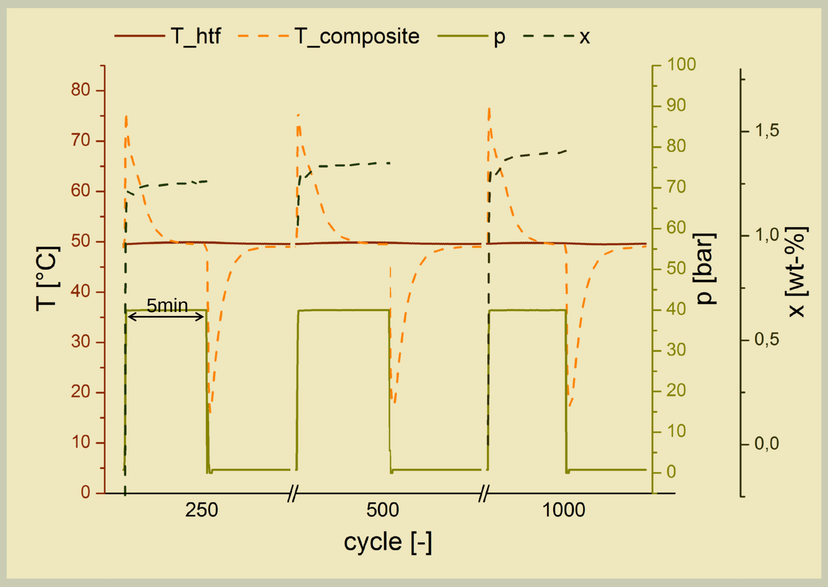
Facts about the Test Bench

- investigation of **large quantities** of material (up to 300 g of bulk material)
  → investigation of **complete structures** (e.g. matrixes for heat transfer enhancement)
- possibility to operate automatically
  → **high number of cycles in short time**
- temperature range: 50 – 400°C
- pressure range: up to 100 bar
- **possibility of steep pressure surges**



Schematic of Test bench and picture of reactors

Test Results for Hydralloy C5-Graphite Composites



Test results for C5-composites

Hydralloy-graphite Composites fabricated by Fraunhofer Institute for Manufacturing Technology and Advanced Materials IFAM, Branch Lab Dresden, Germany

Solid lines show conditions given by test bench: temperature *T_htf* of heat transfer fluid and pressure *p* of hydrogen

conditions constant for every cycle

Dashed lines show behavior of C5-composite for cycle 250, 500 and 1000: temperature *T_composite* inside the bulk structure and hydrogen uptake *x* for absorption

tested composites show long term cycle stability

Conclusion

- **Test of large quantities of material bulks or complete structures possible**
- **Constant conditions for every cycle (temperature, pressure)**
- **Assessment of material behavior (temperature, hydrogen uptake) and of cycle stability for over 1000 cycles in short time**

Talks **DLR: Bürger** Jul 21st 11.30am, Compass,
IFAM: Heubner Jul 22rd 3pm, Compass, **Herbrig** Jul 24th 12.10pm, Hexagon

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