

## INTRODUCTION

### Importance of Cycle Stability

Application areas of metal hydrides:

- Hydrogen storage
- Thermochemical devices
  - heat storage
  - heat conversion systems

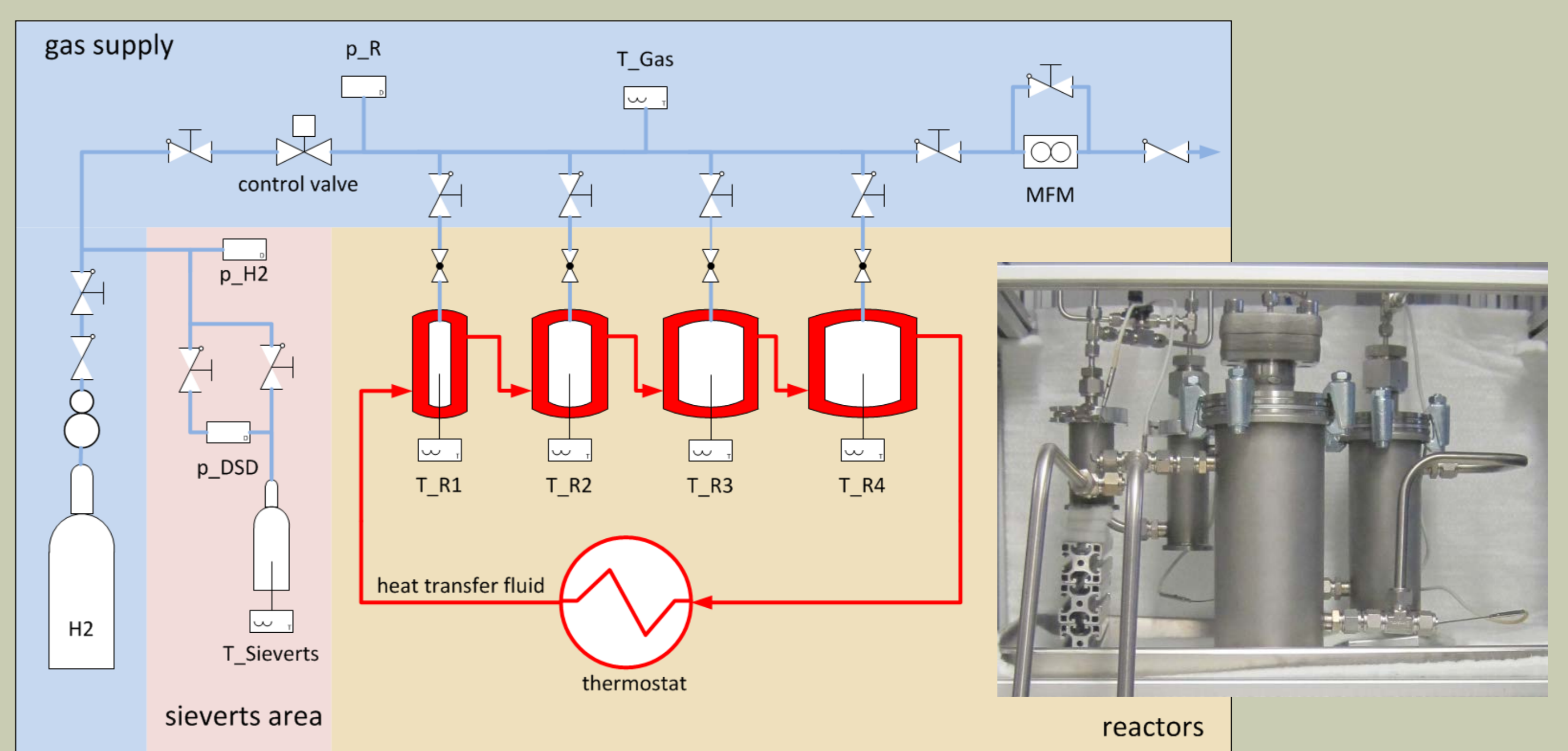
→ all applications require  
high numbers of cycles

**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**

### Facts about the Test Bench

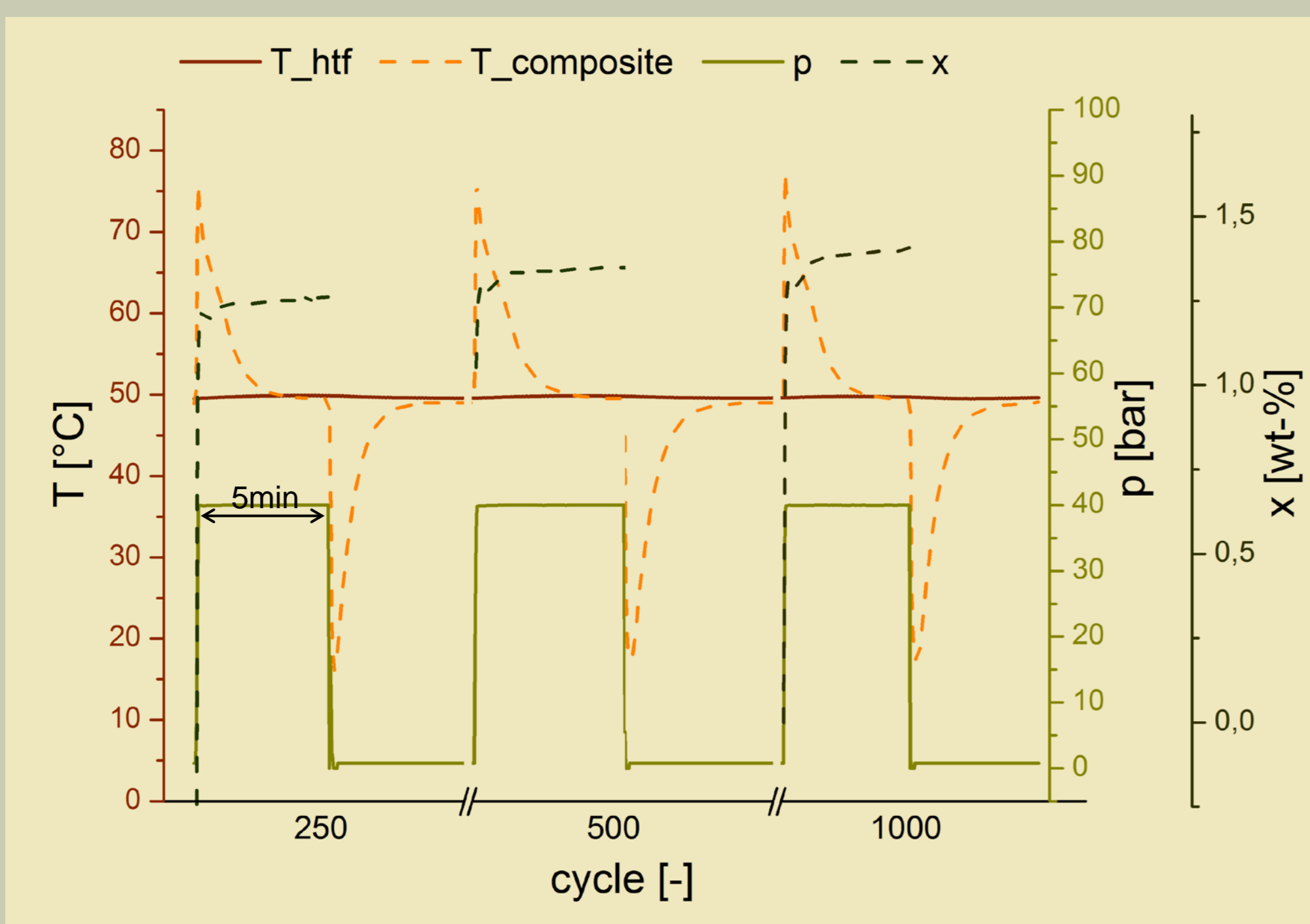
- investigation of **large quantities** of material (up to 300 g of bulk material)  
→ investigation of **complete structures** (e.g. matrixes for heat transfer enhancement)
- possibility to operate automatically  
→ **high number of cycles in short time**
- temperature range: 50 – 400°C
- pressure range: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



Schematic of Test bench and picture of reactors

## PRINCIPLE & RESULTS

### 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 21<sup>st</sup> 11.30am, Compass,  
IFAM: Heubner Jul 22<sup>nd</sup> 3pm, Compass, Herbrig Jul 24<sup>th</sup> 12.10pm, Hexagon

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