

EBZ GmbH, Dresden - GERMANY

Operational Experiences with the EBZ Modular Energy Supply System based on SOFC

1st European Fuel Cell Technology
& Application Conference

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www.sofc-systems.com



Entwicklungs- und Vertriebsgesellschaft Brennstoffzelle mbH

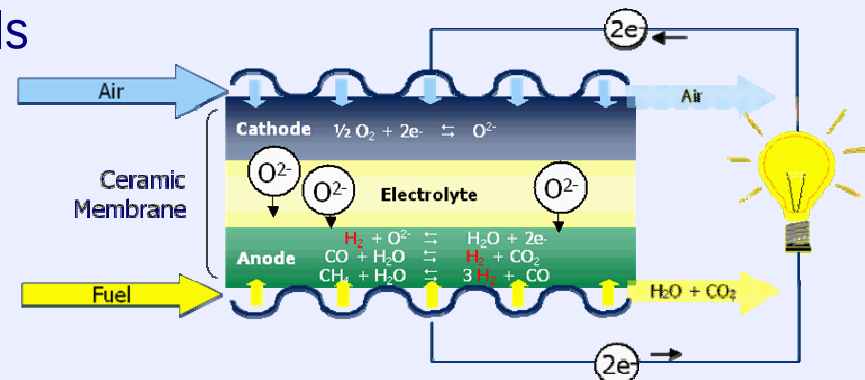
AST Gruppe
Angewandte System Technik

- Founded 2000 in Dresden
- Start SOFC development in 2002
- Member of medium-sized A.S.T. Group (200 employees)
- Office, laboratory and manufacturing building with test-rigs for system and components development / tests



Benefits

- Process temperature: 700-900 °C
 - internal reforming
 - ideal for today available fuels
 - higher electrical efficiency
 - low-cost catalysts
 - but: high material stresses
- Waste heat temperature: ~ 400 °C
 - increased thermal efficiency
 - possible heat usage:
 - sorption cooling, process heat, combined processes, ...



EBZ business model

Company profile

Stack supplier
(depending on appl.)



Modular Energy Supply System 2 - 50 kW_{el}



Components
& Services



→ today

Demonstration
Unit (R&D)



branded subsystems
Niche Market
(EBZ)



→ end of decade

Mass Market
(strategic partners)



Activities and expertises

Company profile

System analysis, modelling and simulation

- Commercially available dynamic system simulation tool
- Optimization of flow sheets, dynamical behaviour
- Test of control strategies

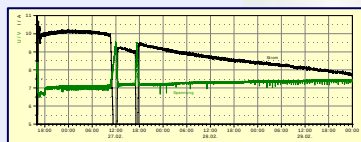
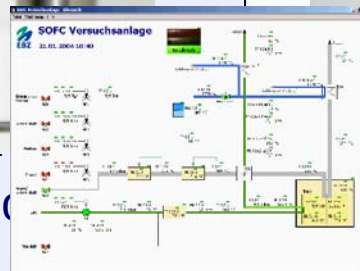
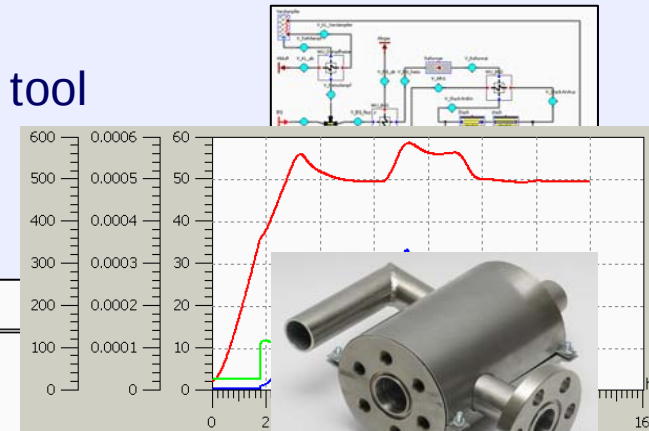
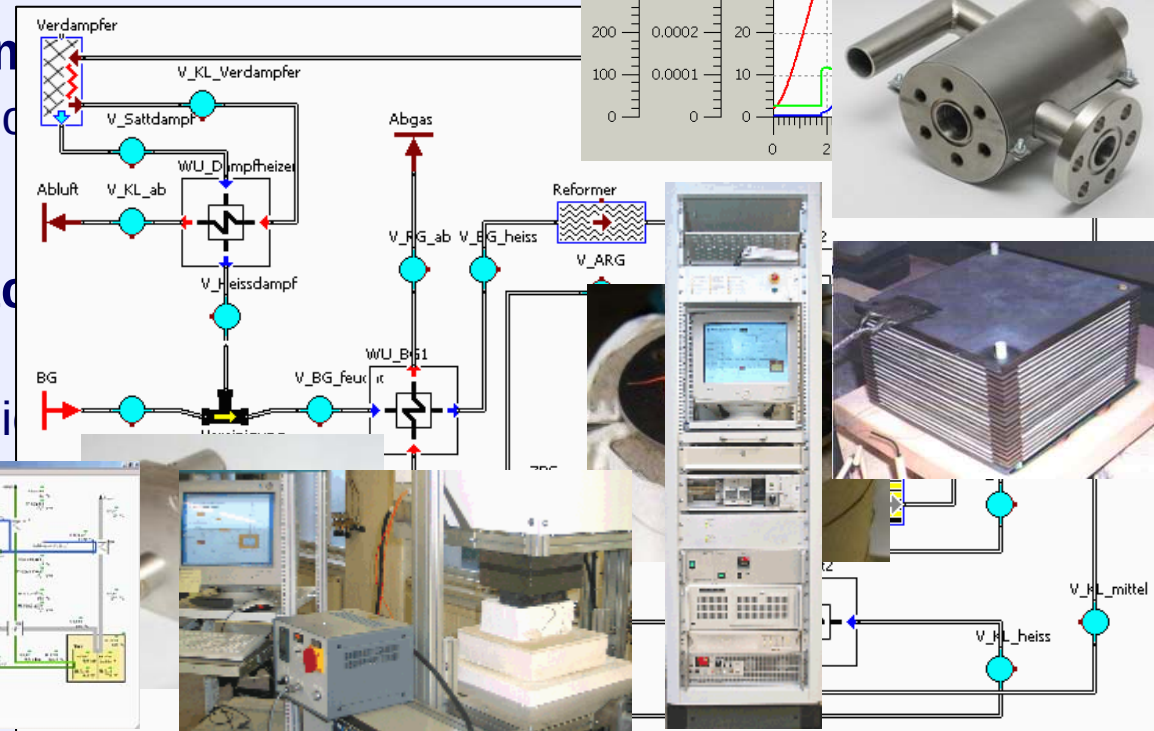
Components development

- Development core components
- Validation in test-rigs

Stack integration and stack operation

- Stack operation
- Component integration

- Remote control



Today's and future projects

Company profile



“EKO-SOFC” 2005 - 2007

Financially supported within the scope of the technology support of the European Funds for Regional Development and by means of the State of Saxony

- increase material liability
- decrease fabrication costs



“REAL-SOFC” 2004 - 2008

Supported by the European Commission

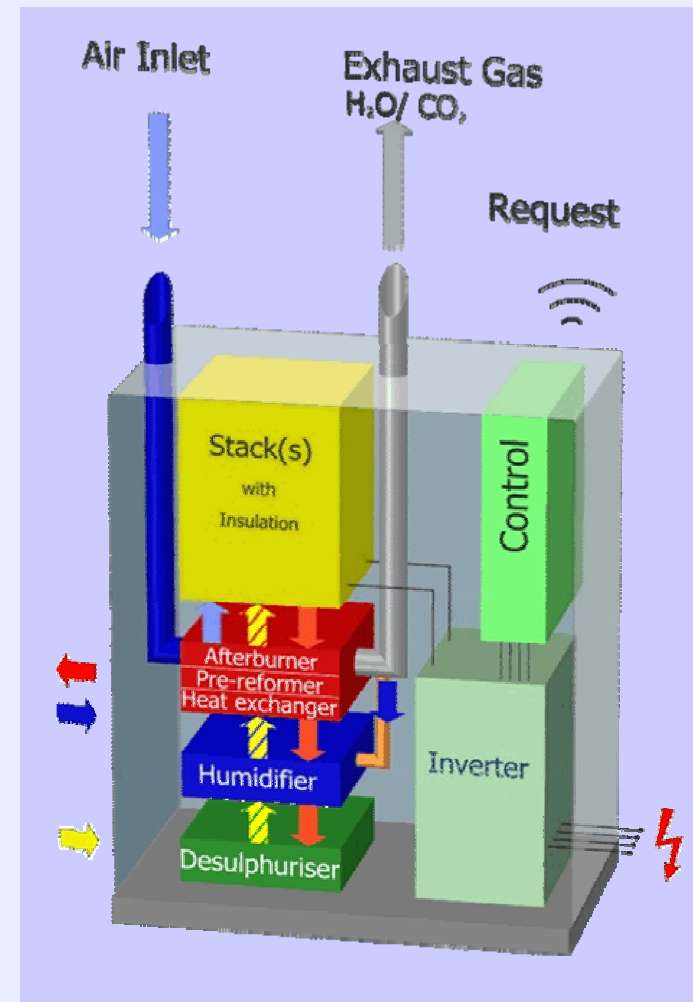
- cell and stack developer
- EBZ: independent stack tester



“FLAME-SOFC” 2005 - 2009

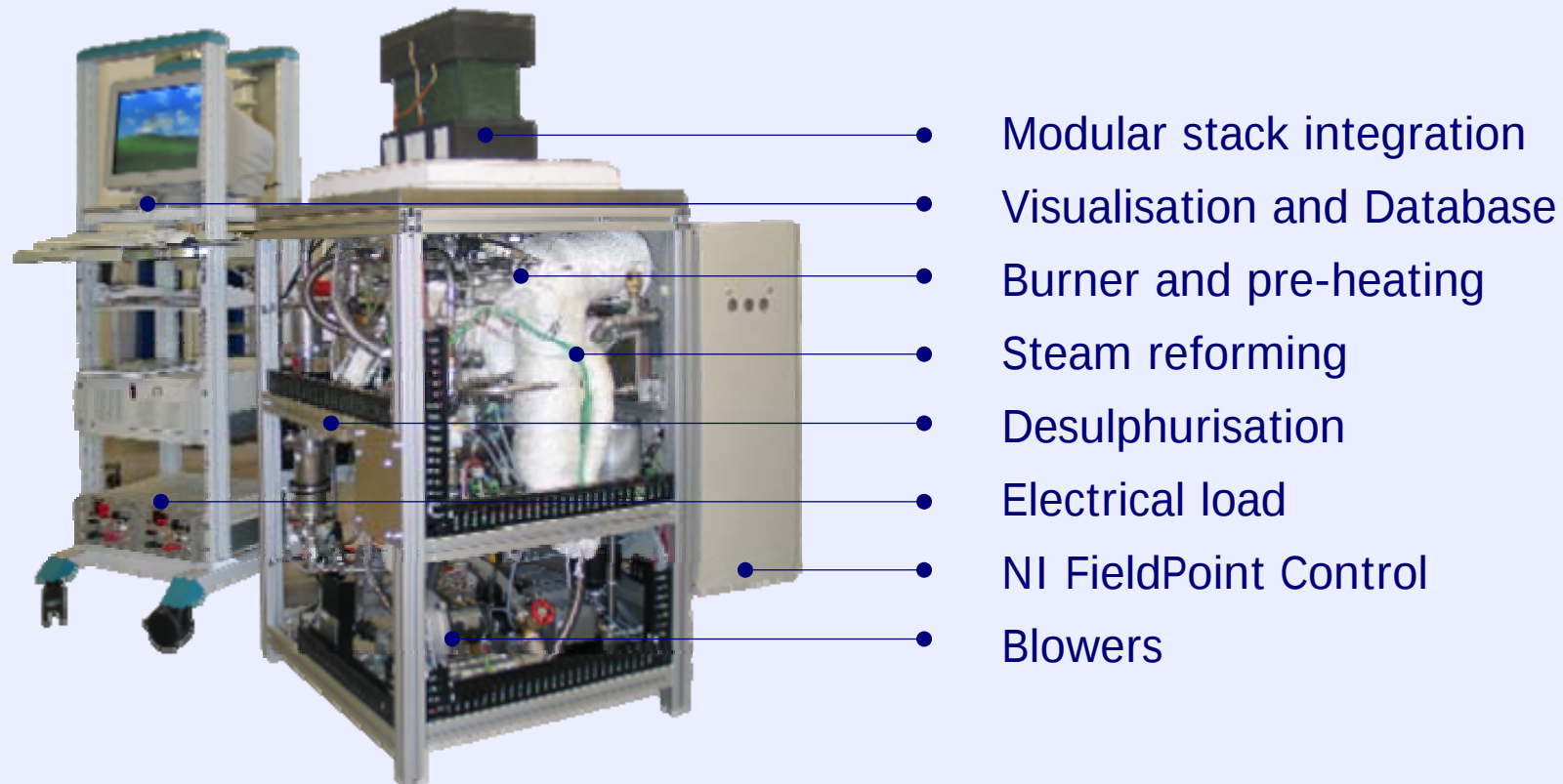
Supported by the European Commission

- robust SOFC-system
- for small stationary applications



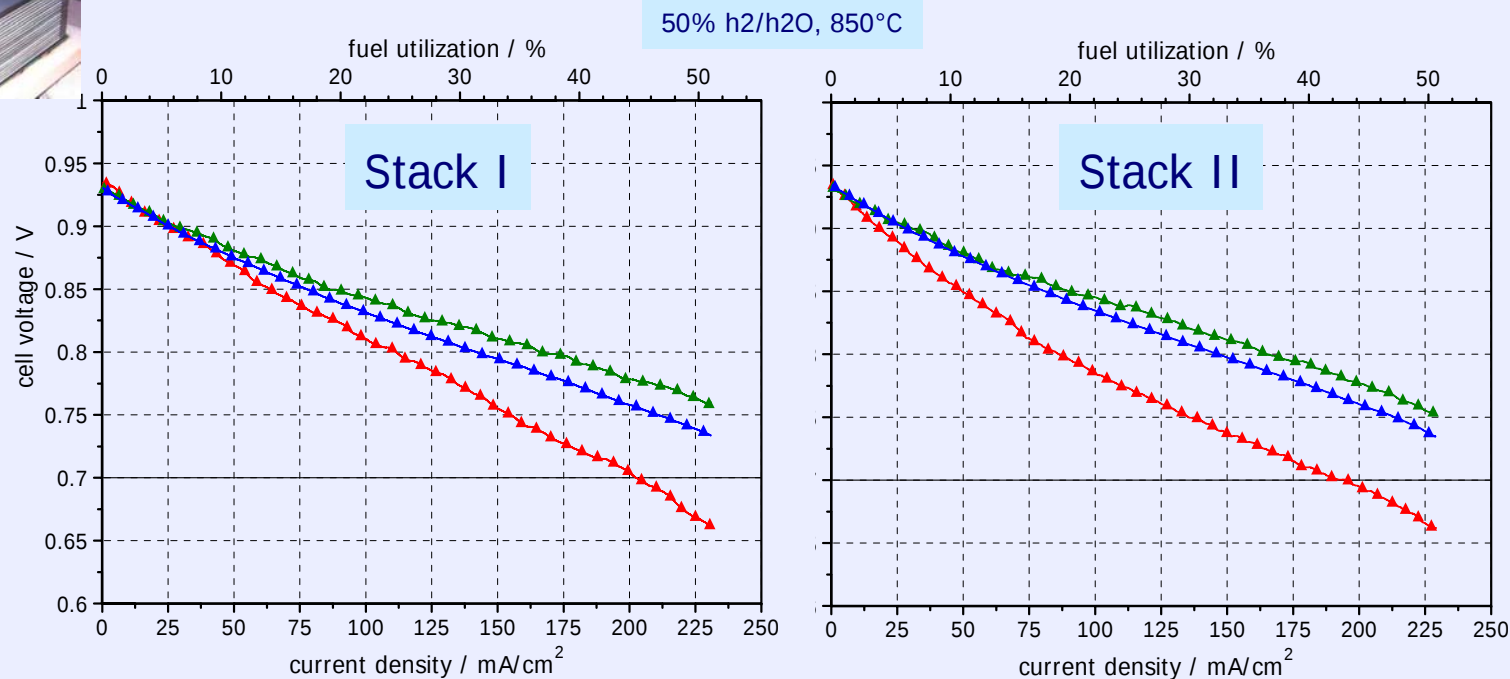
Demonstration unit operation 2004-2005

Operational experiences



Characteristics of stacks supplied by Fraunhofer IKTS

Operational experiences

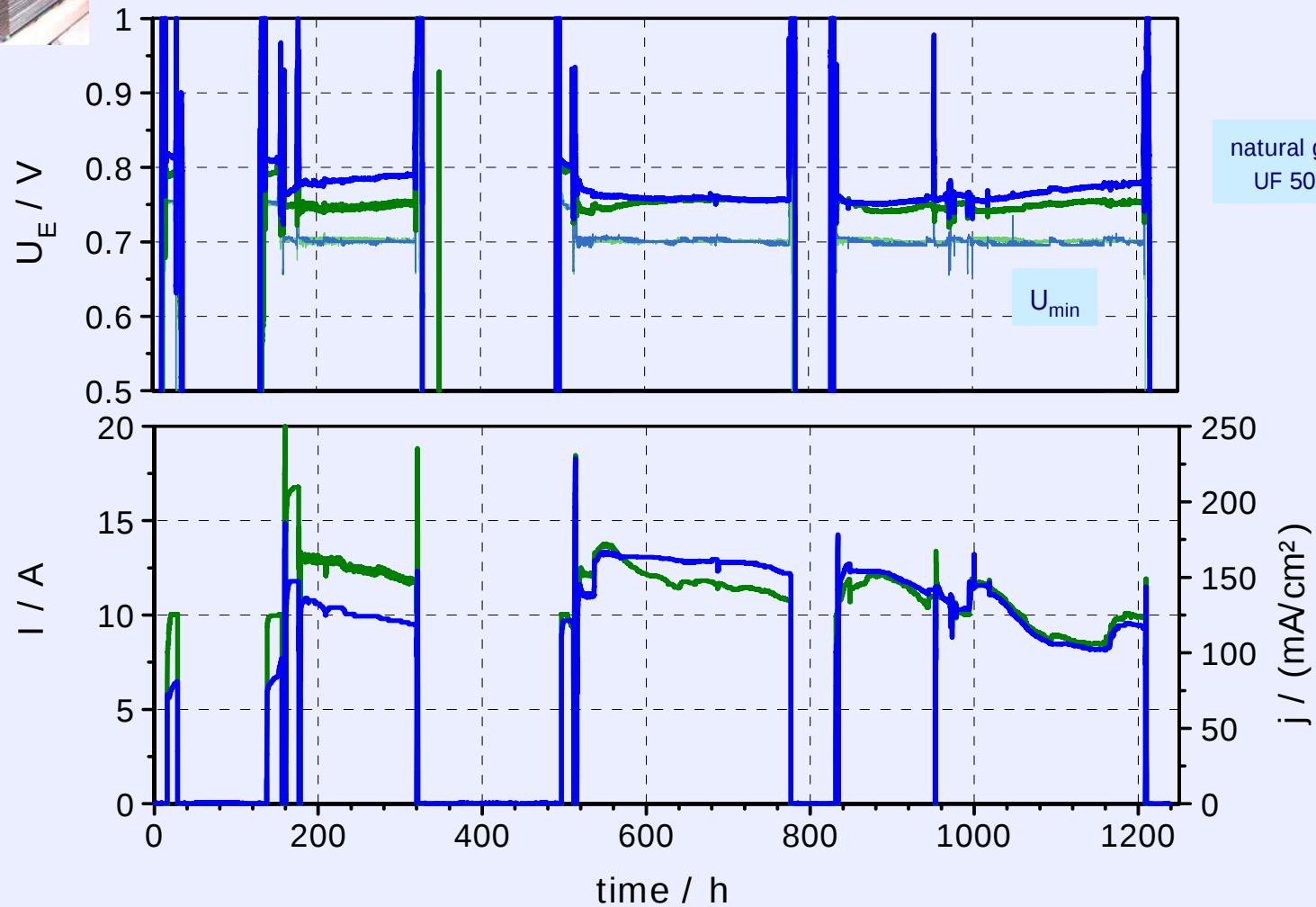


Characteristics of two parallel Stacks (20 cells each) in H_2 mode:

- Minimum and mean cell voltage strongly divergent
- Expected power density not achieved
- Problems at higher fuel utilization and in part-load (cell to cell variations)

Long term

Operational experiences

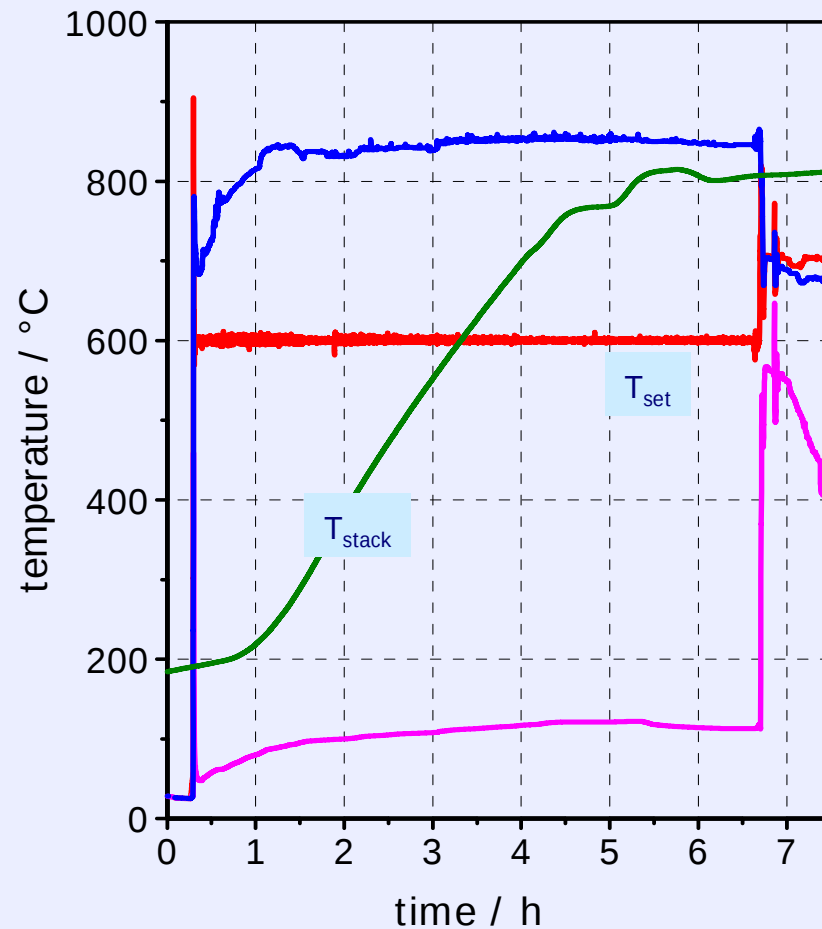


Burner

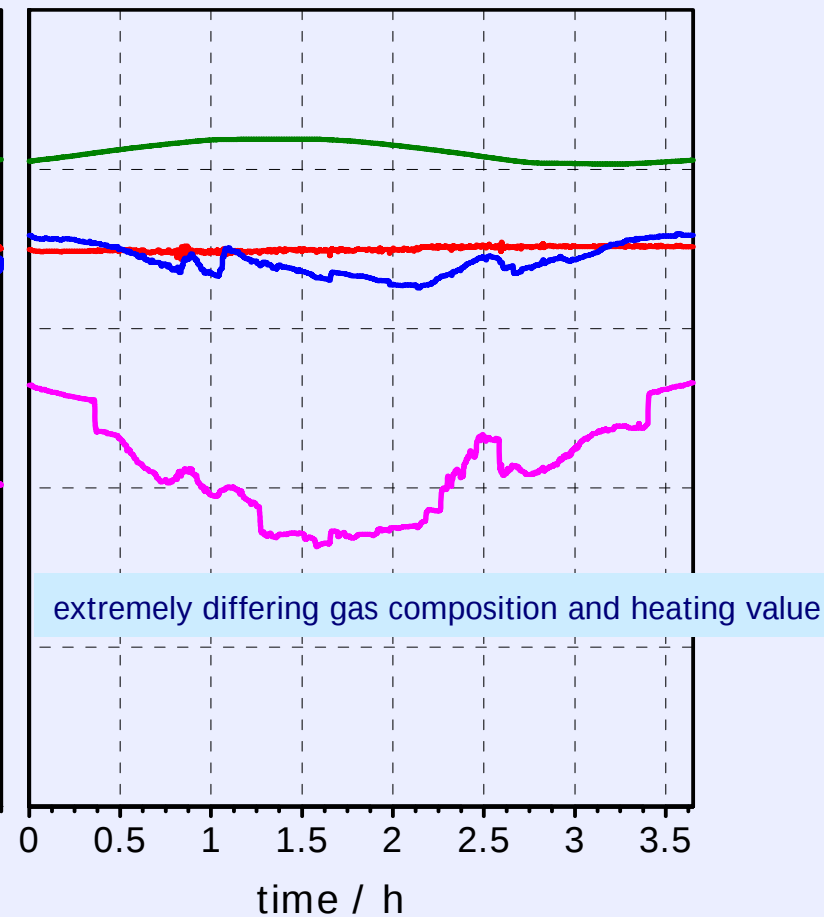


Operational experiences

During Start-up



During stack characterisation

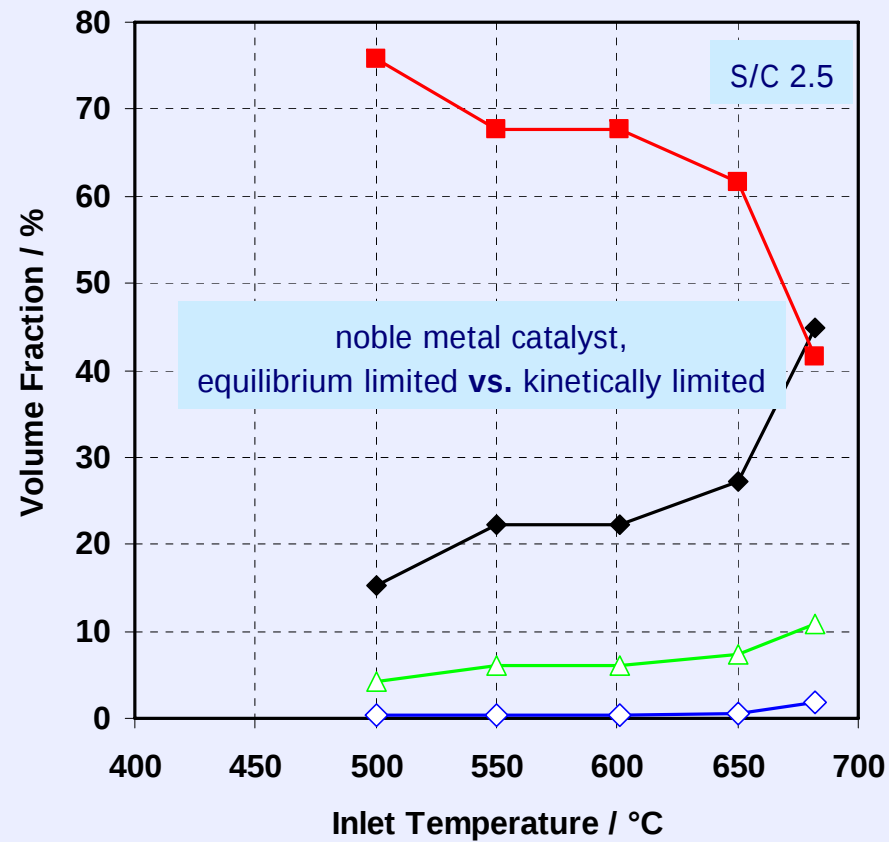


Pre-reformer

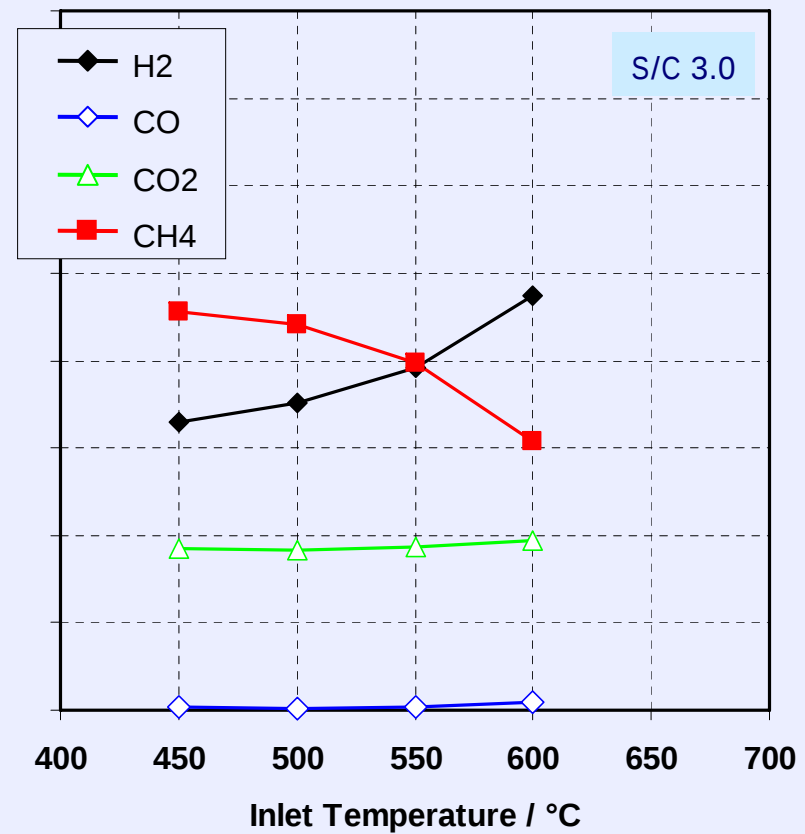
Operational experiences



Natural Gas



LPG



Researcher's benefits

- SOFC test in a real system
- Stack integration 1-5 kW_{el}, < 900 °C
- System customisation regarding:
 - fuel (gaseous/liquid)
 - reforming (steam, POX)
 - sensors
 - heat and power usage
 - visualisation and data management



Operation Summary

Operational experiences

Start-up and off gas burner

- proven operation with natural gas, hydrogen and anode off gas
- wide modulation range

High temperature heat exchanger

- high heat recovery efficiency
- required pre heating temperatures achieved
- low pressure loss

Evaporator

- very low oscillation level

Pre-reformer

- temperature controlled operation implemented

SOFC stacks

- Power (volume & mass) density are “nice to have”
- Low-cost and reliability (long term and cell2cell) are “the musts”



Thanks

Thank you
for your attention!

