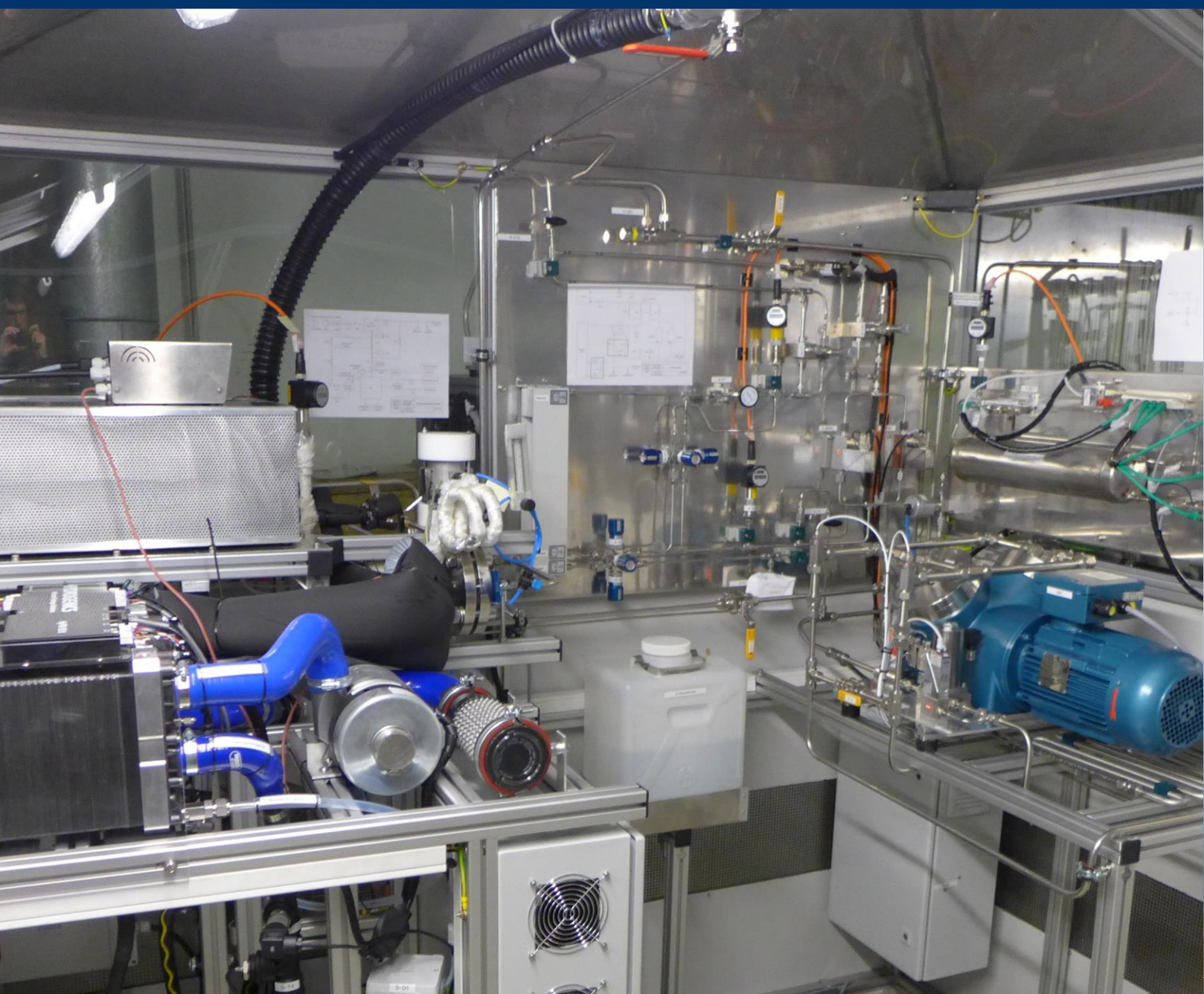
Fraunhofer
IISB

FRAUNHOFER INSTITUTE FOR INTEGRATED SYSTEMS AND DEVICE TECHNOLOGY

Fuel Cell System Technologies for Exhaust Hydrogen and Diluted Hydrogen

Characterization, System Integration and Dilution Effects



Description

The Fraunhofer IISB operates a research platform for converting unpressurized exhaust or diluted hydrogen into electric energy. Single system components like PEM fuel cell systems, compressors or organic membrane filters as well as complete system architectures can be characterized and evaluated.

The components can be analyzed with a hydrogen/nitrogen gas mixture of 0-100% hydrogen content and variable relative humidity over a wide temperature area. Extensive sensor system facilitates a accurate efficiency definition on stack level as well as system level.

The automated test bench can also be used to characterize fuel cell system behavior for inert fuel impurities and nitrogen crossover effects. For the anode fuel delivery system both configurations, flow through and recirculation, are available. The effects of nitrogen as fuel dilution are modelled at system level by Matlab/Simulink.

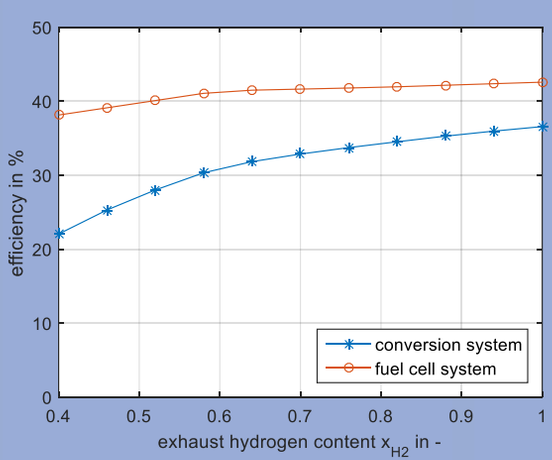
Technical Data of Conversion facility

fuel cell stack	
max. power	8 kW
technology	PEM
exhaust gas simulator (H_2/N_2 mixtures)	
gas flow	0-120 Nl/min
hydrogen content	0-100%
compressor system	
gas flow	0-180 Nl/min
input pressure	1-1,2 bara
technology	membrane (single stage)

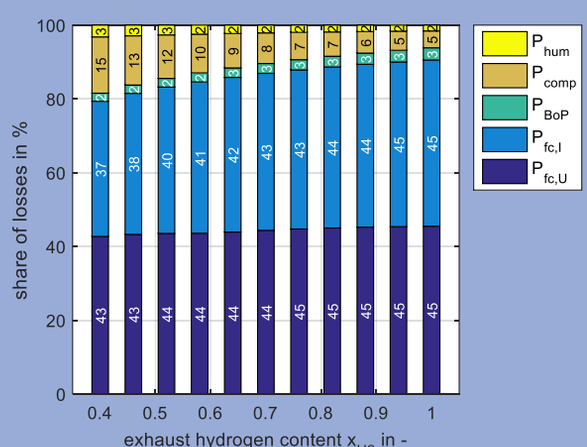
Services and Solutions

- Characterization of fuel cell stacks and fuel cell systems up to 10 kW especially for nitrogen diluted hydrogen
- Analysis and system development for conversion of exhaust hydrogen streams into electricity
- Experimental setup and characterization of complete exhaust hydrogen conversion systems
- Research on dilution effects for fuel supply systems of fuel cell systems including recirculation and purge strategy

Verification of conversion system efficiencies by experiments



Simulated efficiency of the total conversion system and the fuel cell system for different hydrogen contents in an exhaust stream



Distribution of power loss for the conversion of unpressurized exhaust hydrogen into electricity. Power loss for humi-dification P_{hum}, compressor system P_{comp}, balance of plant for fuel cell P_{BoP}, fuel loss of fuel cell system $P_{fc,I}$ and voltage loss of fuel cells $P_{fc,U}$

Fraunhofer Institute for Integrated Systems and Device Technology IISB

Schottkystrasse 10
91058 Erlangen, Germany

Contact
Dr.-Ing. Richard Öchsner
Tel.: +49 9131 761-116
Richard.Oechsner@iisb.fraunhofer.de

www.energy-seeds.org
www.iisb.fraunhofer.de

Funded by
Bavarian Ministry of
Economic Affairs and Media, Energy and Technology