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FRAUNHOFER INSTITUTE FOR SOLAR ENERGY SYSTEMS ISE

1 *20 kW_{el} test bench, walk-in climate chamber, and 28 channel electro-chemical impedance spectroscopy system for stack and system characterization.*

2 *Solar hydrogen refueling station H2MOVE of Fraunhofer ISE.*

CHARACTERIZATION OF PEM FUEL CELLS, STACKS AND SYSTEMS

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Qualified measurement data provide the foundation for successful product development. Objective test results serve as the basis for successful marketing.

To meet our customers' needs, Fraunhofer ISE offers scientifically validated analyses in combination with application oriented and standardized tests on PEM fuel cells, stacks and systems.

Our customers benefit from experimental results which help to optimize cell, stack and system designs as well as operation strategies.

In-situ Characterization of Single Cells

- sensitivity analysis of cell designs and operation strategies with respect to load, operating temperature, humidification, composition and pressure of reactant gases
- durability evaluations considering operation strategy and components or materials
- accelerated stress tests of cell components according to international or customized test protocols
- operation strategy investigations under extreme climate conditions (e.g. freeze start) on single cell level
- testing contamination effects of air pollution, hydrogen contamination or corrosion

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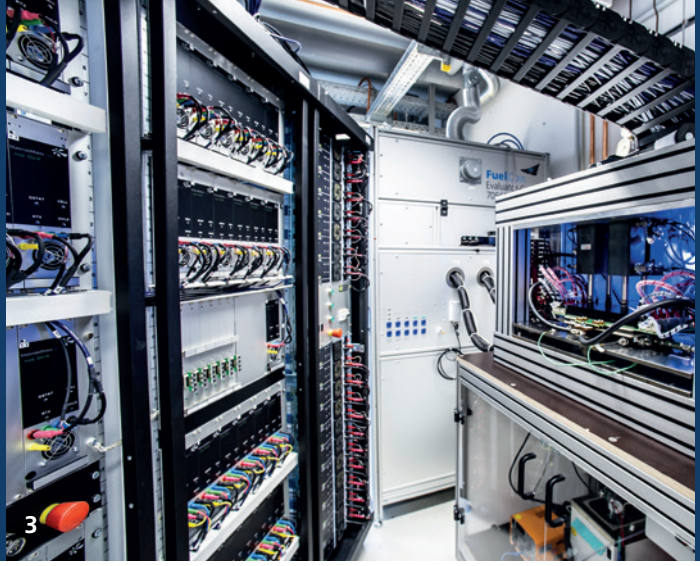


In-situ Characterization of Stacks and Systems

- stack testing up to 20 kW_{el} or 1000 A, system testing up to 30 kW_{el} nominal power or 50 kW_{el} peak power
- sensitivity analysis of stack as well as system designs and operation strategies with respect to load, operating temperature, humidity of gases, gas composition, pressure
- durability evaluations considering operation strategy and components or materials
- analysis and development of freeze start strategies in a walk-in climate chamber under extreme conditions from -40 °C to 80 °C and from 5 to 95 % relative humidity
- implementation of balance of plant components to evaluate the fuel cell stack performance in a system

Model-based Analysis of Experimental Results

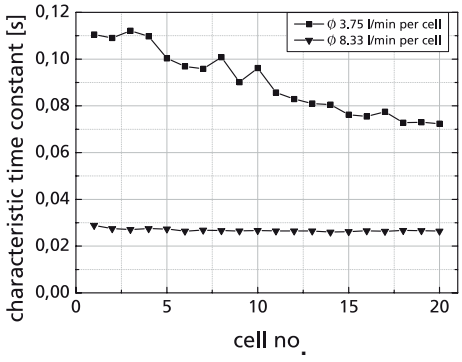
We have developed scientific validated models to extract and analyze properties that are difficult to measure, like flow distribution in single cells and stacks.

Testing of Balance of Plant Components

- cyclic load testing of valves, compressors, humidifiers, etc.
- leakage tests, also with pressurized hydrogen
- temperature stability tests from -40 °C up to +95 °C in a 335 liter climate chamber
- climate tests from +5 °C to +95 °C and from 10 up to 95 % relative humidity
- power consumption measurements under different operating modes or cyclical operation

3 *Test stand for spatially resolved characterization of segmented full-size single cells.*

4 *Laboratory for performance and degradation analyses of cell components.*



5 *The analysis of the electrochemical impedance spectra of single cells within an automotive short stack reveals the gas flow distribution at two different air stoichiometries.*