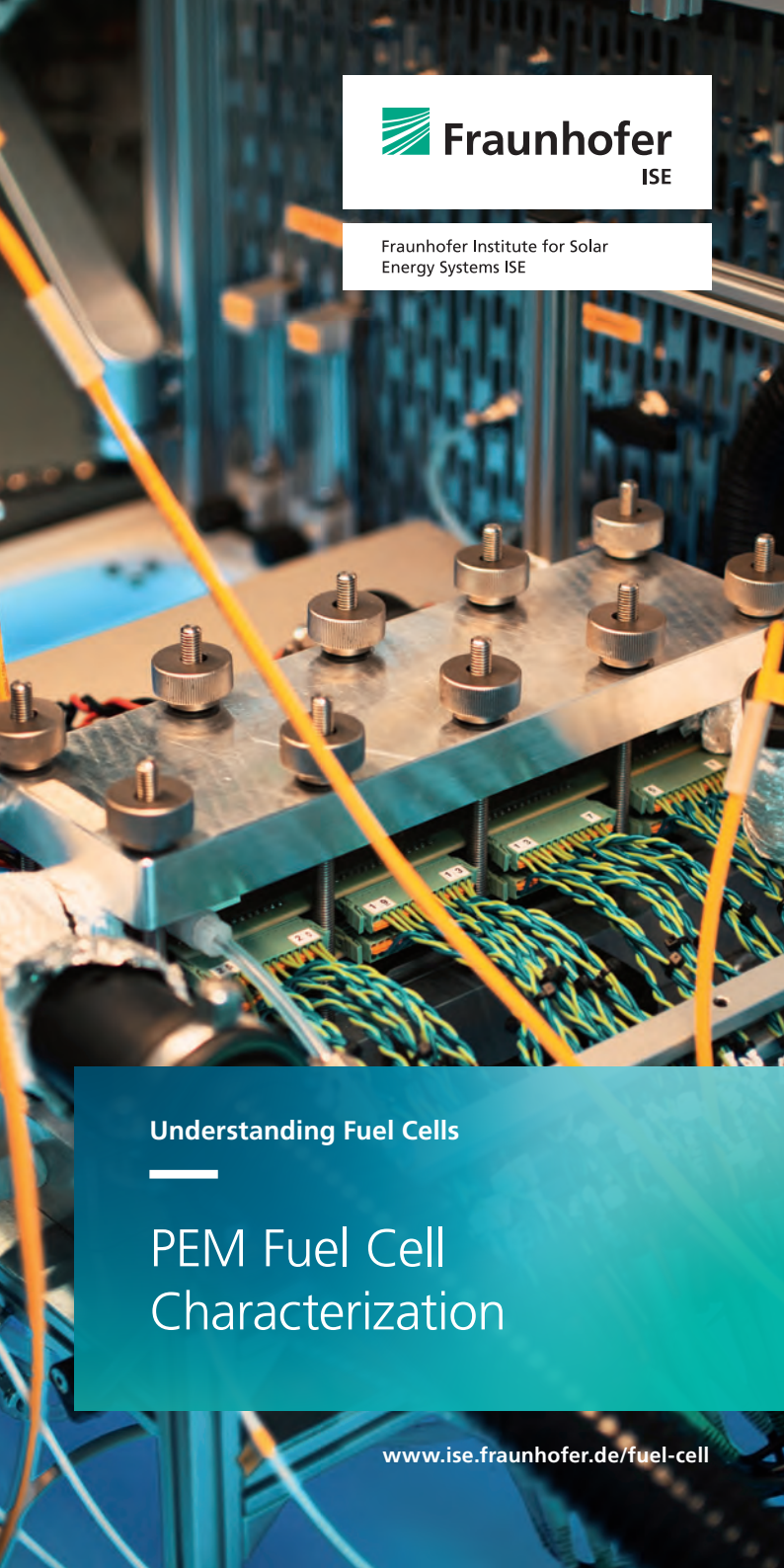

Fraunhofer ISE

Fraunhofer Institute for Solar Energy Systems ISE

Understanding Fuel Cells

PEM Fuel Cell Characterization

www.ise.fraunhofer.de/fuel-cell

PEM Fuel Cell Characterization

A comprehensive in-situ characterization of the membrane electrode assembly (MEA) and its layers in terms of performance and degradation at different operation conditions provides the basis for our customers' decisions on suppliers, production processes, fuel cell stack designs and operation strategies.

Our Offer

- in-situ electrochemical characterization of MEAs and their layers in differential lab-scale test cells to investigate the effects of different materials or production processes at various operating conditions
- in-situ characterization with short stack test station (4 kW, 10 kW, 20 kW) and full stack test station (200 kW) to evaluate stack design, component selection and operation strategy by sensitivity analysis with respect to different operation conditions (temperature, humidity, gas pressure, stoichiometry, stack orientation, load transients, etc.)
- fully automated state-of-the-art test stations for dynamic operation and high reproducibility
- temperature chamber for stack characterization under extreme climatic conditions

In-situ characterization of membrane electrode assemblies in fuel cell stacks

In-situ Characterization of Membrane Electrode Assemblies and their Layers

- state-of-the-art differential test cell for well-defined operating conditions across the entire active area
- state-of-the-art single cell test stations with fully automated operation, electrochemical characterization and data processing
- electrochemical methods: polarization, electrochemical impedance spectroscopy, linear sweep voltammetry, cyclic voltammetry, limited current density, carbon monoxide stripping, carbon monoxide displacement
- characterization of the effects of gaseous or liquid contaminants
- operation up to 120 °C cell temperature
- simultaneous characterization of four single cells

In-situ Characterization of Metallic Flow Field Plates

- investigation of metallic foils and coatings in lab-scale test cells regarding degradation and contamination effects during fuel cell operation
- pre- or post-coating
- ex-situ analysis of corrosion current measurement together with element analysis of the electrolyte or product water via inductively coupled plasma mass spectroscopy and interfacial contact resistivity measurement

In-situ Characterization of Local Effects

- investigation of spatially resolved effects with respect to different operation strategies, flow field designs and materials
- customer-specific flow field designs and test protocols available for along-the-channel test cells and full format test cells
- spatially resolved characterization regarding current density and cyclic voltammetry
- fully automated operation for long-term investigations

In-situ Characterization of Fuel Cell Short or Full Stacks

- fully automated test stations especially designed for dynamic test protocols
- single cell voltage and impedance monitoring
- stack operation for temperatures up to 120 °C
- anode recirculation with adjustable volume flow, purge duration and purge intervals

Characterization of membrane electrode assemblies and bipolar plates in Fraunhofer ISE's fully automated single cell test stations

We understand MEAs

Our core competence in fuel cells is our understanding of the membrane electrode assembly (MEA) – the electrochemical heart of a fuel cell. We emphasize four perspectives in our research and development.

A strong in-situ characterization with state-of-the-art electrochemical measurement techniques enables us to evaluate MEA behavior in fuel cell operation.

Together with a broad range of ex-situ analytical equipment, we can correlate MEA performance and degradation with its microstructure.

With our industry-like MEA production processes, we are able to design specific MEA architectures and use selected material compositions.

Our modeling confirms our physical understanding of the MEA and allows for assessment of variations with regard to materials and operation mode.

Further Information

Contacts

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