Application Example

Cross-Scale Characterization of Catalyst Coatings

Focus

3-dimensional structure of the catalyst-coated membrane (CCM) and its change during operation

Goal

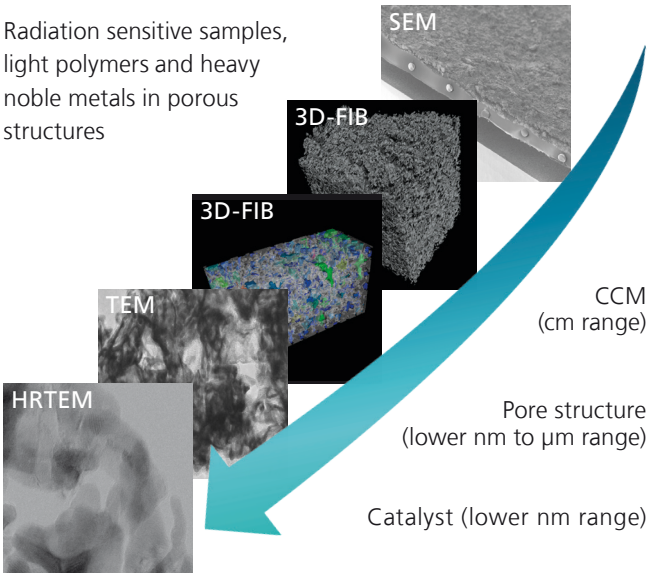
Identification of relevant structural properties and degradation mechanisms

Methods

SEM, TEM, EDX, CT, XRD, XPS, ToF-SIMS, AFM, ESEM, FIB ...

Challenge

Radiation sensitive samples, light polymers and heavy noble metals in porous structures



Competencies

Cross-Scale Material Analysis and Microstructure Diagnostics

Microstructural Diagnostics

- SEM
- FIB
- TEM
- CT, SAM

Material Analytics

- XPS
- ToF-SIMS
- TEM-EDX, SEM-EDX
- XRD

Multi-Physical Analysis

- Optical & spectroscopic methods
- Magnetic field analysis
- Elect. characterization

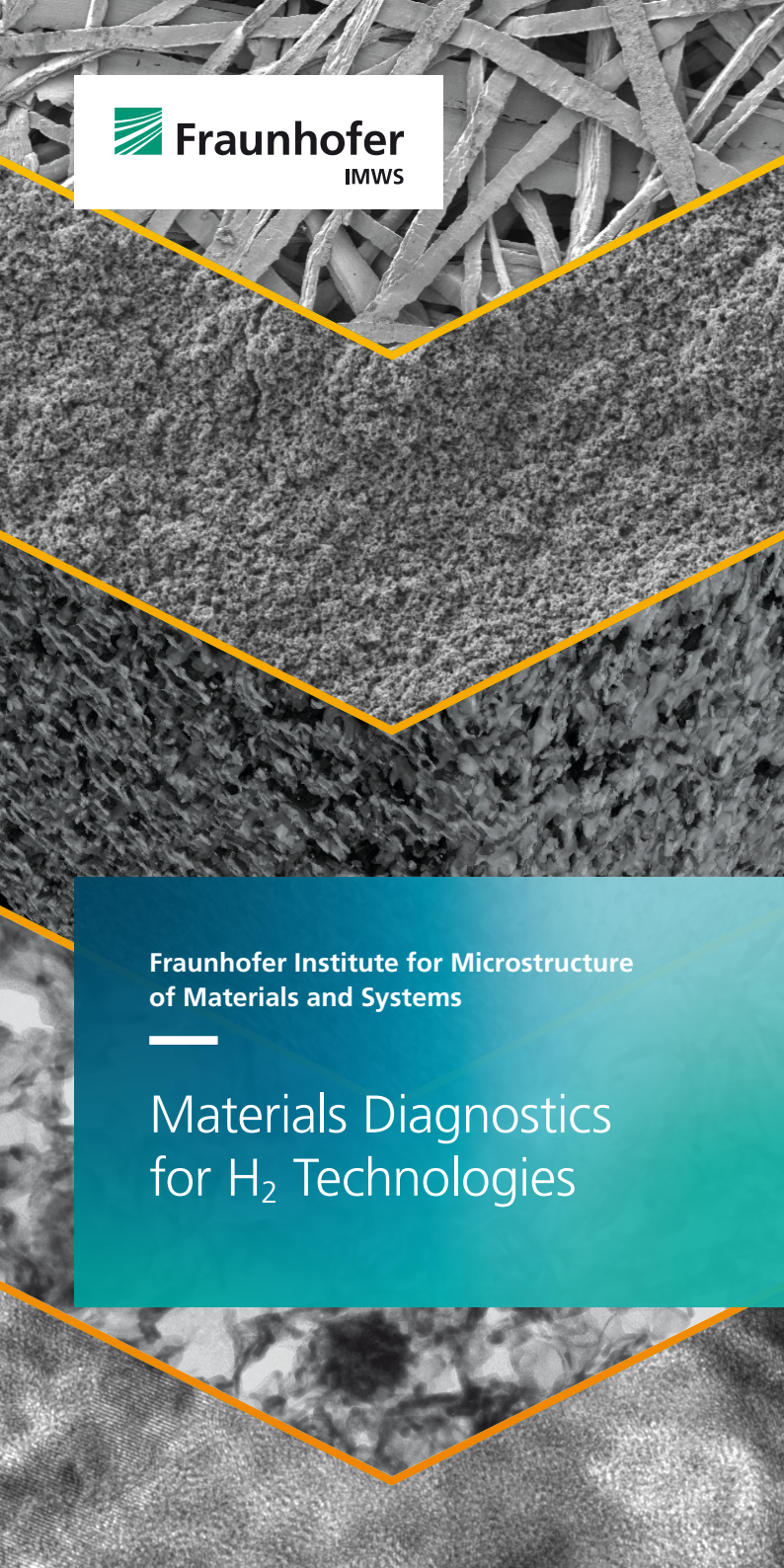
New Developments

- Method and device development
- Device construction
- Standardization

Contact

Dr. Klemens Ilse
Materials Diagnostics for H_2 Technologies
Tel. +49 345 5589-5263
Fax +49 345 5589-101
klemens.ilse@imws.fraunhofer.de

Fraunhofer IMWS
Walter-Huelse-Strasse 1
06120 Halle (Saale) | Germany
www.imws.fraunhofer.de



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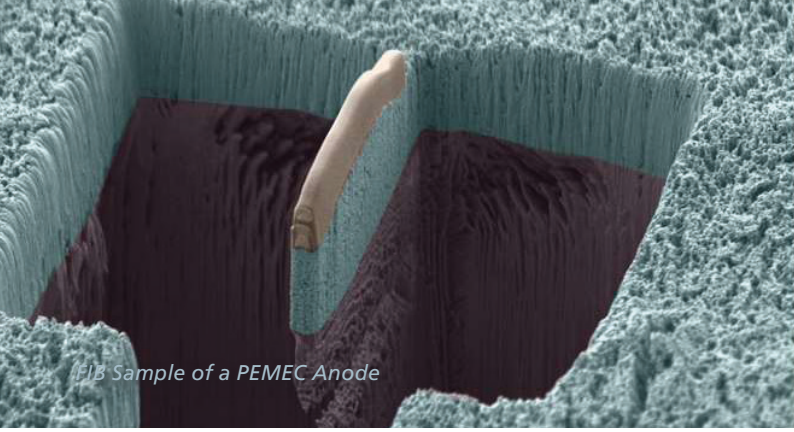
Materials Diagnostics for H_2 Technologies



FIB Sample of a PEMEC Anode

»What Went Wrong?«

Defect Diagnostics for Fuel Cells and Electrolyzers

Value Proposition

We identify defect causes and defect mechanisms, supporting the production and operation of fuel cells and electrolyzers.

Key Activities

- Specially developed, multi-physical and large-scale analytical methods to identify defective regions
- Optimized target preparation and high-resolution material analysis and microstructure diagnostics to resolve defects down to atomic resolution

Examples of Development Topics

- Increasing lifetime and reliability through identification of material weak points (e.g. pinholes in coatings)
- Root-cause-analysis for clarification and understanding of efficiency losses or breakdown during operation

Magnetic Field Image of a Defective PTL

»Will It Go Wrong?«

Quality Control in Production & Operation

Value Proposition

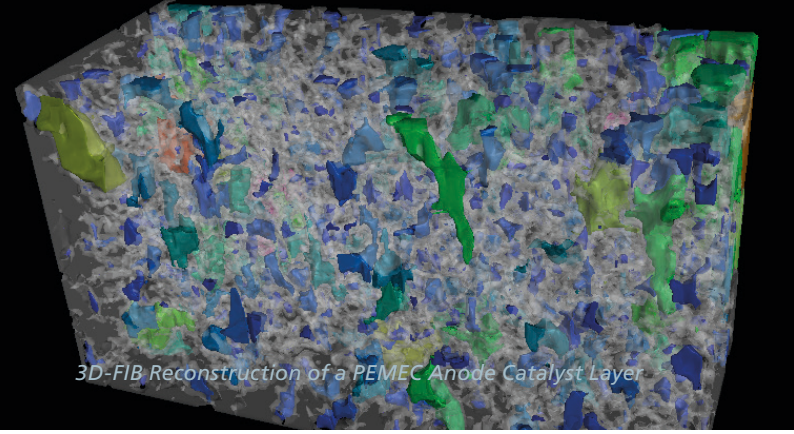
We develop, test and advise on inline, online, atline, offline and in-situ methods for optimized and cost-efficient quality control in production and operation.

Key Activities

- Development of multiphysical, large-scale applicable and production-suitable analysis methods for material properties
- Establishment of high-rate, production-oriented or production-accompanying material analysis and microstructure diagnostics

Examples of Development Topics

- Identification of current-active defects in components using magnetic field imaging
- Process monitoring using sensor bipolar plates
- Identification of material defects and impurities in production with LIBS



3D-FIB Reconstruction of a PEMEC Anode Catalyst Layer

»Microstructure and Materials by Design«

Accompanying the Development of Optimized Materials and Processes

Value Proposition

We accelerate and optimize development processes and enable more targeted and faster product and material design.

Key Activities

- Understanding the production process and the optimal material design to identify relevant material characteristics
- Using cross-scale microstructure analytics and diagnostics to support the optimization of relevant process parameters

Examples of Development Topics

- Reduction/substitution of platinum metals for catalysis
- Optimization of the microstructure of catalyst layers
- Optimization of titanium-based BPP and PTL
- Corrosion coatings for water cycle components