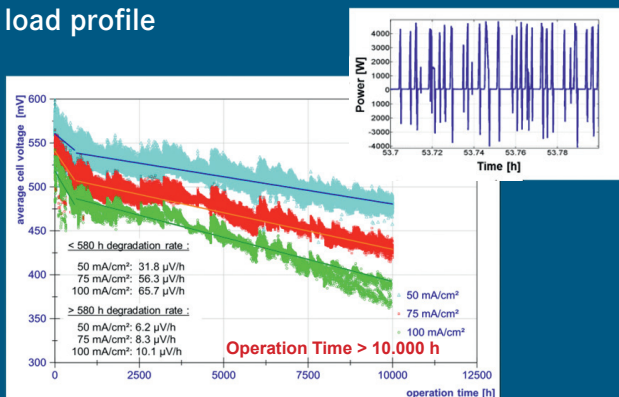
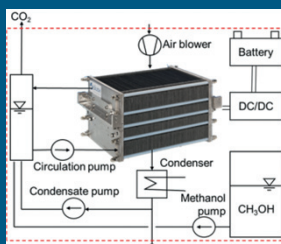




DMFC durability test with realistic load profile



“Jülich, 10 February 2012 – Ten thousand hours in operation: Scientists from Forschungszentrum Jülich set up this record with a hybrid system based on direct methanol fuel cells (DMFCs). The fuel cell stack – a block composed of 88 fuel cells – in this project funded by the Federal Ministry of Economics and Technology (BMWi) is designed for use in an order picker, a type of electric forklift truck.”



Technical data

drive module	peak power	7kW (fuel cell battery hybrid system)
		water autonomous @ 35 °C
	MeOH cartridge	20l, 30h operation time
	battery	lithium ion high power (1kWh @ 24V)
stack	nominal power	1.3 kW
	number of cells	88
	lifetime	> 10,000 h
MEA	power density	75 mW/cm² @ 450 mV
	Pt/PtRu-loading	4.5 mg/cm²/cell

Co-operation

The implementation of low-temperature fuel cells and stacks for stationary, portable or mobile applications extending up to complete systems with fuel cells is a core competence of the Institute of Energy Research – Fuel Cells (IEK-3). The development presented here is part of a joint project funded by the German Federal Ministry of Economics and Technology (BMWi) under contract numbers 0327769A/0327769B and 03ET2002.

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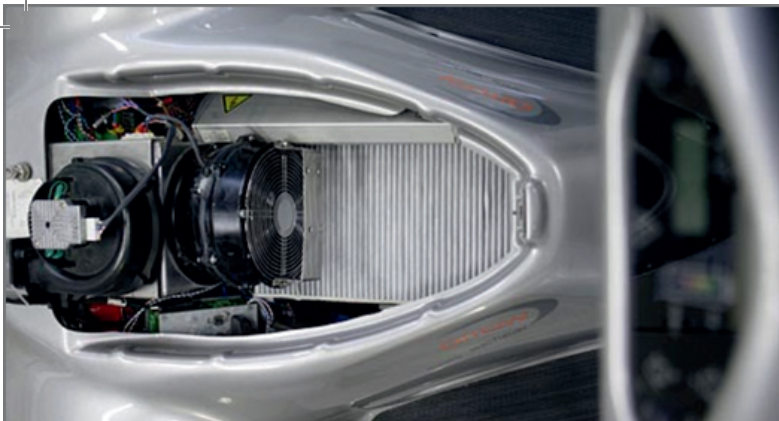
4/2012



R&D Focus on Direct Methanol Fuel Cell Systems

Institute of Energy and Climate Research –
Fuel Cells (IEK-3)





From Components up to Direct Methanol Fuel Cell Systems

DMFC research and development activities

A prerequisite for the market introduction of DMFCs for light traction is not only high power density and long-term stability but also a cost level that is comparable to existing technologies. In this way, work is concentrated on the development of durable and inexpensive stacks and the realization of compact DMFC systems up to 5 kW.

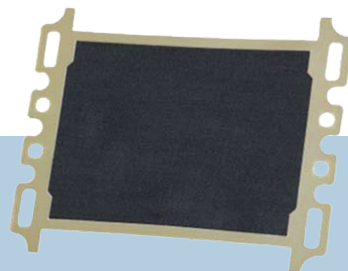
Possible applications for DMFC systems in the kW class:

- Light traction
- Auxiliary Power Unit (APU)
- Household
- Industrial logistics
- Special applications

Join our DMFC activities in the following fields:

- | | |
|----------------------------|---|
| MEA development: | <ul style="list-style-type: none"> • Light traction • Power density • Durability |
| Stack development: | <ul style="list-style-type: none"> • Power density • Heat and water management |
| System development: | <ul style="list-style-type: none"> • Efficiency • Hybridization |
| System integration: | <ul style="list-style-type: none"> • Simplification • Optimization |

Production techniques for MEA and stack components.



DMFC-MEA-Development

Aims:

- High power-density ($> 0.1 \text{ W/cm}^2$)
- Durability ($> 10,000 \text{ h}$)
- Low air stoichiometry (> 3)

R&D activities:

- Durability testing of single cells
- Studies of effects of impurities on electro-chemical performance
- Adaption of layer design onto improved materials
- Adaption of coating techniques onto functional layer demands

Equipment:

- Line-Coater, Base-Coater
- Doctor blade, screen printing
- Slot type nozzle
- Fuel cell lab
- Electrochemical test facilities
- Permeability measurements



DMFC-Stack-Development

Aims:

- High power-density ($> 300 \text{ W/l}$)
- Durability ($> 10,000 \text{ h}$)
- Quality assurance
- Graphite and metallic bipolar plates
- Safe and durable sealing

R&D activities:

- Operation of stacks in the range from 200 W to 5 kW
- Durability testing of stacks
- Determination of the influence of load profile on durability
- Design and construction of stacks
- Automated stack assembly

Equipment:

- Automated durability test facilities
- Robot assisted stack assembly
- Automated quality assurance
- Electrochemical test facilities
- Permeability measurements



DMFC-Stack-Development

Aims:

- Power density ($> 50 \text{ W/l}$)
- Hybridization
- Durability ($> 20,000 \text{ h}$)
- System efficiency ($> 35 \%$)
- Closed water loop up to $> 40 \text{ }^\circ\text{C}$ ambient temperature

R&D activities:

- Durability testing of Systems
- Development of water management
- Test of system components
- Development of systems hybridization

Equipment:

- Automated durability test facilities
- Climate-testing laboratory
- Air humidification test facility
- FTIR gas analytics
- Two flexible test fields