



## go.PEF-CH

# ENHANCING PEFC DURABILITY AND RELIABILITY UNDER APPLICATION-RELEVANT CONDITIONS

## Annual Report 2007

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### SUMMARY

go-PEF-CH is a project within the PEF-CH framework, involving academic institutions (Paul Scherrer Institut PSI, Berner Fachhochschule für Technik und Informatik BFH-TI) and Swiss Industry (CEKA, MESDEA). 2 PhD theses are to be carried out under the aegis of PSI. The objective is to investigate membrane electrode assembly (MEA) degradation phenomena and aging mechanisms under application-near operating conditions, encompassing rapid load transients and start-stop cycles.

So far, no suitable candidates for the 2 PhD positions have been identified.

The kickoff meeting of 'go.PEF-CH' was held on Nov. 30 at PSI.

The Swiss hydrogen and fuel cell community came together on the occasion of the Impulse Day 2007, organized by the SFOE and hosted by PSI, giving extensive opportunity for exchanging ideas and networking.

## Project Objectives

The market introduction of products based on the polymer electrolyte fuel cell (PEFC) technology is limited to a large extent by the **aging** and **premature failure** of the electrochemical components and **lack of reliability**. The objective of this project is to **investigate aging and degradation phenomena** in the form of 2 PhD theses in the framework of the **PEF-CH** network, in close collaboration with the **Swiss industry**.

Major factors limiting durability under application-relevant conditions are rapid **transients** (changes in load) and **start-stop cycles**. Novel diagnostic tools under development at PSI will provide insight into aging phenomena of membrane and electrodes and failure mechanisms and their dependence on operating strategies in single cells and stacks, with experimental support by the 'Berner Fachhochschule für Technik und Informatik (BFH-TI)'. The insights gained will enable the improvement of the **operating strategy**, cell components and design, giving the industry partners key knowledge to allow certification of their PEFC stacks and systems with respect to lifetime.

Furthermore, the acquired results and findings are envisaged to spawn follow-up projects involving further academic institutions (e.g. ETH) and funding partners (CTI, CCEM, SNF), also on a broader scale (EU).

## Completed Tasks and Obtained Results

The 2 PhD positions are being advertised on the PSI homepage ([www.psi.ch](http://www.psi.ch)) and other job sites since the start of the project. So far, no suitable candidates have applied.

The kickoff meeting was held on Nov. 30 at PSI, involving all partners.

## National Collaboration

PSI is the 'leading house' for the PEFC technology in Switzerland. It has participated in numerous national collaborations (e.g. PowerPack, HY.LIGHT) with academic institutions (e.g. ETHZ, ZHAW) and industrial partners (CD Michelin)

PSI is currently working together with the 'Laboratory for Anorganic Chemistry (LAC)' (Prof. Koppenol) in the framework of a PhD thesis on fundamental degradation mechanisms of polymer electrolytes and model compounds. Furthermore, PSI has had and is having student's projects (internships, semester and master thesis) together with ETH.

## International Collaboration

On an academic level, PSI works together with the Japanese Atomic Energy Agency (JAEA) in the area of fuel cell membrane diagnostics. There were also a number of students programmes (internships, diploma theses) with various universities in Europe.

In the area of fuel cell diagnostics, PSI is collaborating with a number of automotive companies (e.g. Nissan Motor Co.).

The EU project CARISMA is a coordinated action on high temperature (120 - 180 °C) membrane electrode assemblies and degradation phenomena. A number of workshops were held in 2007, which offer an excellent opportunity to exchange ideas with experts in the field from academia as well as industry.

## Review 2007 and Outlook 2008

**Highlights:** preparatory tasks well underway: test facility upgrade at BFH-TI, 1'700 h lifetime reached for the IPHoS system by CEKA (200 W) under constant conditions (420 mA/cm<sup>2</sup>, T= 65°C).

**Lowlights:** Suitable candidates for the 2 PhD positions have not been found yet.

The primary goal for 2008 is to be proactive in the search for PhD candidates, in order to start the project as soon as possible.