

### Motivation and Objectives

Present problems of Polymer Electrolyte Fuel Cell (PEFC) technology related to the commercialization are cost, durability, reliability, performance, and public acceptance. The DECODE project is focusing on improving durability taking the water management, especially liquid water, into account. Water management of PEFC is one of the crucial issues for the performance and the life-time.

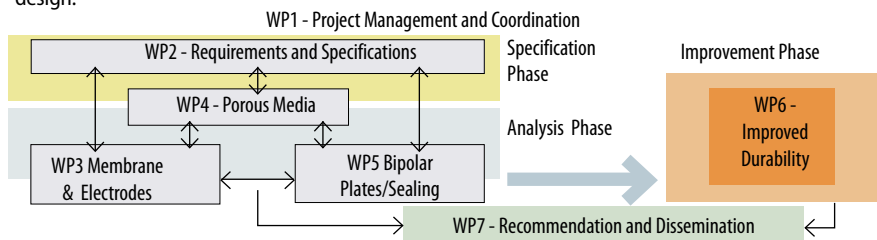
The main objective is to increase the life-time of fuel cells for automotive applications focusing on liquid water interactions. Different work tasks have been performed in order to meet the objectives below:

- To understand the influence of the degradation processes on the fuel cell performance and on the fuel cell behaviour especially on the water management/water balance in the fuel cell,
- To describe the degradation of fuel cells based on the individual degradation processes,
- To derive operating strategies for higher durability, reliability, and stability,
- To demonstrate an improved life-time with improved components and operating strategy.

### Project Structure

The project is split into three phases:

- The specification and definition phase for materials, components as well as testing and operating conditions,
- The analysis phase for the investigation of the individualism of degradation processes of the components (WP3: membrane and electrodes; WP4: porous media; WP5: bipolar plates) and their interactions,
- The improvement phase for the generation of the technological progress incl. development of fuel cell operating strategies to mitigate degradation phenomena and to improve components and single cell design.



### Technical Approach

- Experimental studies of the degradation mechanisms and processes of single components, single cells, and short stacks. All investigations are performed to understand the influence of operating conditions.
- Modelling of transport processes and porous media.
- Improvement of operating strategies & materials based on the knowledge of degradation processes.

### Achievements

**WP2:** Materials and test components were defined.

**WP3:** Experimental investigations of CCM degradation were performed. Models to describe interferences of different electrode degradation mechanisms.

**WP4:** Experimental investigations of GDL degradation were performed. Modelling tools for simulation of transport processes of porous media were developed.

**WP5:** Ex-situ investigation of stack components were performed. Long-term tests (1000 h) with more than 20 short stacks were performed.

**WP6:** Main degradation processes have been identified. Suggestions for the improvement of components were developed and applied for their modification (CCM, GDL, bipolar plate including the sealing). The improved components and the improved operating strategy were tested and an increased life-time was demonstrated.

**WP7:** The project was presented at different conferences and workshops. The workshop "International Workshop on Accelerated Testing in Fuel Cells" was organised in cooperation with other partners. DECODE was involved in the CARISMA workshop in September 2010 in La Grande Motte and at the public workshop in Gothenburg in March 2011. Survey studies for WP3 – WP5 were written by the partners.

Budget	5.5 M€
Duration	39 months
DG	Research
Coordinator	K.A. Friedrich, DLR
Partners	11 partners, among them Opel, Volvo
Website	www.decode-project.eu

Funding	3.7 M€
Start	January 2008
Contract n°	213295
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