

Project Information

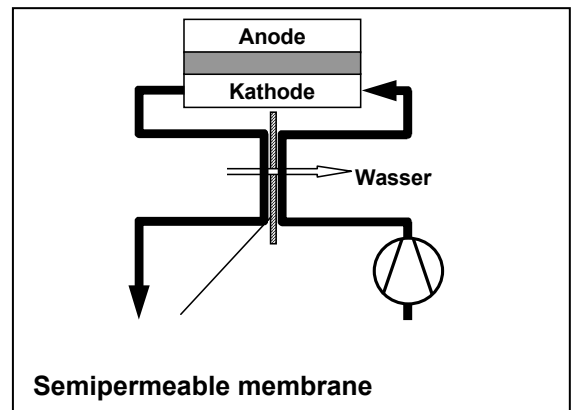


Subject: Development of a Humidifier for PEM Fuel Cells with Energy Recovery

Applicant: FEV Motorentchnik GmbH
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Project Duration: 30.10.2000 – 31.3.2003

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Project description / Status of work:

The intention of this project is to explore the potential of a regenerative water management in PEM fuel cell systems. The fuel cell needs humidified air to prevent the membrane from desiccation, since this would increase the cell's internal impedance. Regenerative systems are able to avoid the condensation of water in the cathode offgas stream, which is still necessary in common systems. The water is directly transferred from the offgas to the fuel cell's cathode feed air stream. This project examines two different concepts of regeneration in a theoretic as well as in an experimental way.

First, a sorption regenerator is tested, which removes water from the offgas by adsorption and which humidifies the fresh air stream of the cathode side by desorption. Transmission efficiencies of up to 35% could be realised with a size of the sorption unit of $0.35 \text{ l} / \text{kW}_{\text{el,FC}}$.

Further on, a water permeable membrane is studied, where the difference of the partial pressure of the water vapour initiates the vapour transfer from the cathode offgas to the fresh air stream. With the same size, compared to the sorption generator, efficiencies of about 60% could be reached. The minor complexity and the lower susceptibility to failure are additional benefits of this humidification method.

A simulation model was developed in order to describe the behaviour of this water permeable membrane, and was compared to the measurements. This model enables the investigation of interactions between the humidification module and the fuel cell system, and can be used for the targeted dimensioning of membranes and for the optimisation of the system efficiencies.