

Project Information



Subject: Development of compact 5 kW fuel cell stacks with polymer electrolyte membranes

Applicant: Forschungszentrum Jülich GmbH
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Project duration: 01.09.01 – 31.08.04

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Project description / status of work:

Within the framework of this project, DMFC systems and PEFC stacks in the 5 kW class are being optimized and developed. In the first project phase, a scaling up to the size of 5 kW is effected based on the experience gained with the DMFC stack of the 500 W class exhibited at Hanover Fair 2001. In the second project phase, this 5 kW DMFC stack is then to be optimized in two further steps and partly automated with respect to MEA manufacture, and the demonstration of the 2nd and 3rd development stages is to be performed in the 1 kW power class. In parallel to this, an optimized 5 kW PEFC stack is developed in three steps. The PEFC stack is to be optimized with respect to humidification, water management and pressure operation. For the DMFC stacks, above all, the manufacturing process, the structure and the composition of the functional layers, the reduction of catalyst coating and long-term stability are to be improved.

The project was successfully completed by presenting two DMFC systems in the 1 kW class and constructing a 5 kW PEFC stack. Both the portable and the mobile DMFC system are characterized by compact design, which was possible due to the great progress achieved in component development, stack design, system simplification and system integration. In stack development, for example, the power density of the 1.3 kW DMFC stack was increased to 90 W/kg using expanded graphite for the bipolar plate and the flow field. This is three times as much as for the 2.5 kW DMFC stack built in 2002. Furthermore, the 1.3 kW DMFC stack, which reaches a max. power of 1.8 kW at a mean cell voltage of 350 mV, displays a minimum cathodic pressure loss of just a few mbars. This permits the use of economy-type fans. The noble metal demand was halved by optimization work in component development and the mass transport in the cathode of the DMFC-MEA improved so as to drastically reduce the air throughput required. The membrane electrode assemblies (MEAs) were manufactured in a continuous, mechanized fabrication process with a high degree of reproducibility both for the DMFC stack and for the 5 kW PEFC stack with the aid of a desk coater. In this way, an important milestone of the project was achieved as well.

