

Project Information

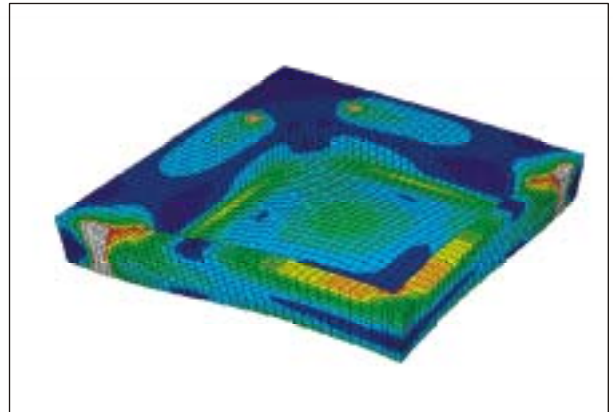
Subject: **Simulation, design and optimization of endplates for fuelcell stacks**

Applicant: Universität Siegen
 Institut für Mechanik und
 Regelungstechnik
 57068 Siegen

Project duration: 01.09.2001 – 31.08.2004

Project partner: Forschungszentrum Jülich (IWV 3)

Contact: Univ.-Prof. Dr.-Ing. Wilfried Becker
 Tel.: +49-271 / 740-4641
 Dipl.-Ing. Jens Artel
 Tel.: +49-271 / 740-4643



Project description:

Within the project, weight-optimal endplates for direct-methanol-fuel-cells (DMFC) are to be developed. In the course of the mechanical design process of these endplates, a useful combination of some parameters such as thickness of the plate, boundary geometry, locations of screw connections and predefined deformations have to be determined and verified. The choice of these parameters determines the mechanical performance of the stack, in particular the mechanical behaviour in operation. These loads are thermal and especially hygroscopic loads, which result from swelling of the electrolyte-membranes. In order to achieve high stack performance and lifetime the endplates have to be simulated, designed and optimized in terms of weight by using the best possible combination of geometric parameters.

By using Kirchhoff's hypothesis a mechanical-analytical modeling of the endplate has to be performed which can be validated and rated using numerical methods such as the finite element method. For design improvement a sensitivity analysis concerning the alterable parameters – the design variables – has to be conducted. For this purpose mathematical methods of structural optimization are used to generate the best possible design, which can not be found with a simple Trial-and-Error analysis. Therefore it is essential to transform the technical problem into a mathematical optimization problem, to simulate the behaviour of the system, to evaluate useful optimization algorithms and to perform the numerical optimization.

The alternative use of endplates which are predeformed to reach a constant pressure in the stack under operation conditions will be determined. Alongside these plates should have sufficient local mechanical strength and stiffness as well as a low weight and should be easy to manufacture.