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Conference Abstract:

Mechanical analysis and functional design optimisation of PEM electrolyser endplates by FEM simulation

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The mechanical behaviour of a PEM electrolyser is especially influenced by the endplates. They are responsible for load introduction and absorption of operating forces. The deflection of the endplate under load correlates with the contact pressure distribution inside the stack. For the active cell area, an uneven contact pressure that deviates from the target value is accompanied by a reduced efficiency, while too low contact pressure in the sealing area can lead to leaks. The distribution of the contact pressure between the active cell area and the sealing area reacts sensitively to changes in the stack configuration or the operating conditions. Increased operating pressure leads to higher deflection of the endplate, resulting in a more uneven normal force distribution.
The optimisation of the endplate design is necessary to improve the contact pressure distribution for different operating conditions and stack configurations. Common strategies from the literature were thicker or mechanically stiffer endplates, topology optimised endplates, a pre-bended endplate design or to adjust the position of the force application. All strategies improve the mechanical behaviour, but the optimization is only suitable for a specific stack design and operating condition. It is still difficult to adjust the force distribution between the active cell surface and the sealing. The load distribution between the two areas still depends on component tolerances, the operating pressure, the load application, the stack configuration, or modified dimensions of the endplate. For the optimization of the mechanical behaviour of the stack the concept of an adjustable endplate is developed. The main innovation is, that the contact pressure on the active cell area can be manually adjusted independently of the operating point and sealing force. The deflection of the endplate has no more an influence on the distribution of contact pressure within the active cell area.

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