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Topology Optimization of Solid Oxide Fuel Cells[1] GRIGORIOS PANAGAKOS, FRIDOLIN OKKELS, DTU Nanotech, Department of Micro- and Nanotechnology, Technical University of Denmark, Denmark — We present a free form optimization of Solid Oxide Fuel Cell models, using a high-level implementation of topology optimization according to [1]. As a first step towards the cell's full optimization, we focus in the design of the interconnect. The interconnect is a key element of the whole cell as it is responsible for separating the anode of one cell from the cathode of its next one in a stack of cells, thus being responsible for the supply of fuel and cooling gases, securing in the same time the efficient conductance of electrons through the stack. Modeling the steady-state operation of a fuel cell incorporates the coupling between different physics, such as reaction, electronic, ionic, thermal and fluid phenomena, and is adequately described in two dimensions. Different objective functions, guiding the optimization method, are being investigated, such like the cell's and interconnect's efficiency, heat convection rate and the inlet flowrates of fuel and cooling gases.

[1] L.H. Olesen, F. Okkels, and H. Bruus, Int. J. Num. Meth. Eng. 65, 975 (2006).

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