Numerical Simulation of the Effects of Obstacles in Gas Flow Fields of a Solid Oxide Fuel Cell

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In this study, the local transport phenomena and overall cell performance of a single planar anode-supported solid oxide fuel cell with/without rectangular obstacles inside the anode and cathode gas flow channels are numerically investigated by using a three-dimensional mathematical model. Numerical results of two cases including temperature distribution, species concentration distribution, and current density distribution are reported and compared. The results indicate that the maximum temperature of the fuel cell with obstacles is about 5 K lower than that of the fuel cell without obstacles. It is also observed that the hydrogen utilization is improved and a more uniform oxygen distribution is obtained due to the presence of rectangular obstacles. In addition, the pressure drop penalty of the fuel cell with obstacles is greatly increased.

Keywords: Solid Oxide Fuel Cells, Numerical modeling, Gas flow channel geometry, Obstacles

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