Investigation of the Electrochemical Performance of Anode-Supported SOFCs under Steady-State Conditions

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A numerical investigation was conducted on the steady-state electrochemical performance of an anode-supported solid oxide fuel cell (SOFC) with various design parameters and operating conditions. A zero-dimensional mathematical model illustrating the electrochemical characteristics of SOFCs was used in this paper. The simulated results showed good agreement with the experimental data. By using this model as a simulation, the steady-state electrochemical performances of SOFCs were studied. Additionally, how the electrode and electrolyte thicknesses, triple-phase boundary (TPB) length, operating temperature, and pressure affected the SOFC performance was investigated. In addition, the effect of the structural and operating parameters on overpotentials was studied. Combining the analyses on the structural and operating parameters, recommendations were provided for optimizing SOFC designs. This work provides systematic suggestions for improving the building of an SOFC electrochemical reaction mechanism model.

Keywords: solid oxide fuel cells, electrochemical reaction mechanism, three-phase boundary, polarization, parametric analysis

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