Micro- Modeling of Porous SOFC Anode

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The electrochemical reaction in a solid oxide fuel cell (SOFC) anode is studied in order to predict the concentration over-potential, which yields one part of the polarization. The model simulates the behavior of anode for hydrogen feed and for methane and steam feed (internal reforming). Anode characteristics such as thickness of the anode, composition of anode (Ni/YSZ content) and pore diffusion play an important role in determining the concentration profiles of fuel, water and the electrode potential[1-2]. Operating parameters, such as current density, composition of feed gas, and rate of heat removal at the anode-electrolyte interface, are investigated.

The preliminary results obtained, showed that similar concentration polarization profiles trend for both hydrogen and reformed methane as a feed. This trend differs at high limiting values such as high current density (>>1000 A/m^2) where the concentration of hydrogen produced by the internal reforming is not sufficient to make up for the consumption at the anode. It is shown that the compositions of anode (Ni/YSZ content) and pore diffusion should be within certain limits in order to increase the performance of the SOFC. Optimum anode characteristics and operating parameters are required for internal reforming of methane to work as if using hydrogen alone.

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References:

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