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Numerical study on the performance of anode supported tubular SOFC

M. Fatih KAYA
Erciyes University, Turkey

Abstract

Numerical models of SOFCs are important tools in understanding and investigating the effect of design and operation parameters on the SOFC performance and development works. In this study, one of the clean and highly efficient energy production systems, single tubular anode-supported solid oxide fuel cell is modeled numerically. Mathematical model of the single tubular solid oxide fuel cell is given in terms of the incompressible Navier-Stokes, Knudsen diffusion models, Butler–Volmer kinetic equations and Brinkman equations. For two-dimensional axisymmetric geometry, operating conditions, parameters of fuel cell and governing equations are solved by using finite element method software Comsol Multiphysics. Pure H2 % 89 and H2O %11 are used at anode side and air is used at the cathode side as reactant gasses. Potential distributions, pressure, temperature, porosity, permeability and especially distance of current collectors to the cell reactant gas inlet are studied. Optimal cell parameters for the considered model are determined and the reasons of cell performance effects are given in detail.

Biography

M. Fatih KAYA has completed his BSc and MSc degrees in Mechanical Engineering department from Erciyes University and is PhD student in the Energy Systems Engineering Department at the same university. He studies on solid oxide fuel cells.