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High temperature PEM fuel cell steady-state transport modeling

Viorel IONESCU*

Department of Physics and Electronics, Ovidius University of Constanta, 124 Mamaia Blvd, 900527, Romania

Abstract A fuel cell is a device that can directly transfer chemical energy to electric and thermal energy. Proton exchange membrane fuel cells (PEMFC) are highly efficient power generators, achieving up to 50-60% conversion efficiency, even at sizes of a few kilowatts. There are several compelling technological and commercial reasons for operating H_2/air PEM fuel cells at temperatures above 100 °C; rates of electrochemical kinetics are enhanced, water management and cooling is simplified, useful waste heat can be recovered, and lower quality reformed hydrogen may be used as the fuel. All of the High Temperature PEMFC model equations are solved with finite element method using commercial software package COMSOL Multiphysics. The results from PEM fuel cell modeling were presented in terms of reactant (oxygen and hydrogen) concentrations and water concentration in the anode and cathode gases; the polarization curve of the cell was also displayed.

Keywords: Maxwell-Stefan equation, molar concentration, polarization curve

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