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A Two-Dimensional PEM Fuel Cell Model ZHONGYING SHI, XIA WANG, ZHUQIAN ZHANG, Oakland University — Proton Exchange Membrane (PEM) fuel cell is a typical low temperature cell, where hydrogen and air are fed into the porous anodic electrode and cathodic electrode though the gas distributors on the bipolar plates, respectively. Activated by the catalyst on anode side, hydrogen will spilt into protons and electrons. Since only protons will be allowed to pass through the membrane, electrons must go through an external circuit. Electrons and protons meet air on cathode side to produce water and heat catalyzed by the catalyst on the cathode side. Numerical simulations are useful tools to describe the basic transport and electrochemical phenomena of PEM fuel cells. The goal of the present work is to develop 2-D computational models of PEM fuel cells, which take into account fluid flow, multi- species transport, current distribution and electrical potential. The velocity field in free channel described by Navier-Stokes equation and the velocity field in porous media described by Darcys Law are coupled along the channel-MEA interface. The governing differential equations are solved over a single computational domain, which consists of two gas channel layers, two gas diffusion layers, two catalyst layers as well as a membrane. The model is solved with commercial software COMSOL Multiphysics 3.2b. Parametric study will be conducted to analyze the effects of various parameters on the performance of PEM fuel cells. The results, including the mass concentration, the polarization curve and the velocity distribution, will be presented.

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