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عنوان مقاله:

A two-phase, non-isothermal model for water management in the cathode gas diffusion layer of polymer electrolyte membrane fuel cells

محل انتشار:

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خلاصه مقاله:

Water management is essential because of its effect on the performance and durability of the polymer electrolyte membrane (PEM) fuel cells. This paper studies the flow in the cathode gas diffusion layer (GDL) of a PEM fuel cell using a non-isothermal two-phase model. For this purpose, the conservation equations of mass, momentum, energy, and other auxiliary equations have been solved numerically and validated with data available in the papers. The results show that the pressure variation of the gas mixture (P_g) along the cathode GDL is negligible, while the capillary pressure (P_c) is significant. An increase in the pressure of the cathode channel as well as the porosity of GDL leads to an increase in the concentration of oxygen in the cathode catalyst layer, but by increasing the porosity coefficient of the electrodes from ۰.۴ to ۰.۷, the effective thermal conductivity of the fuel cell decreases and the maximum temperature of the fuel cell increases by about ۱K. The flow of liquid water and the consequent saturation are higher in the vicinity of the cathode catalyst layer, but due to evaporation, their amount decreases as approach the channel. In the current density range of ۰.۶< j< ۱A/cm^۲, the α parameter (which is defined as the ratio of the water entering from the membrane to the catalyst to the water produced due to the reaction) is nearly equal to ۱.۲, as a result, the water entering the cathode GDL increases proportionally to the current density.

کلمات کلیدی:

PEM fuel cell, water transpot, cathode GDL, two-phase flow

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