

Numerical Analysis of Physical and Electrochemical Phenomena in PEM Fuel Cell

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A mathematical model for PEMFC simulation was developed and improved in order to analyze physical and electrochemical phenomena using Computational Fluid Dynamics(CFD) technique. In this model, momentum conservation equation, species transport equation(H₂, O₂, N₂, H₂O_{vap.}, water content) and charge conservation equation are solved simultaneously.

In this study, we mainly focus on physical and electrochemical behavior in PEMFC system in accordance with its various operating conditions; (i) H₂, O₂, H₂O_{vap.} distribution and their effects on electrochemical reaction in anode and cathode catalyst layer (ii) water content and proton conductivity distribution and their effects on current density distribution in MEA (iii) EOD(Electro Osmotic Drag) effect on water profile in MEA (iv) prediction of polarization curve and cell efficiency based on various operating conditions.