Macroscopic Model Development for PEM Fuel Cell Simulation using Computational Fluid Dynamics Technique

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Geometrically independent model development for simulating Proton Exchange Membrane Fuel Cell (PEMFC) is implemented based on a computational fluid dynamics(CFD) technique.
In this model, five major governing equations are considered for predicting physical and electrochemical phenomena such as flow field, H2, O2, N2, H2O(vap.) mass fraction(or mole fraction), solid-phase potential field, electrolyte-phase potential field and current density distribution.
Phenomenally, solid phase- and electrolyte phase potential distribution exist in anodic and cathodic catalyst layer simultaneously. These two potential fileds play a role as a driving force for electron conduction and proton conduction. In order to solve this electrochemical phenomenon, consideration of volume fraction of each phase into whole governing equations are necessary.
Also, current density distribution is calculated based on the solid phase potential gradient generated and depleted at anodic and cathodic catalyst layer.