# Model of Two-Phase Flow Dynamics for Optimal Water Management in Polymer Electrolyte Fuel Cells

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A three-dimensional, mathematical model for two-phase flow dynamics in polymer electrolyte fuel cells has been developed based on the two-flow model and the mist flow model. Our proposed model basically consists of three zones to account for water flow dynamics: (i) a single-phase flow zone in the gas channel, (ii) two-phase flow zones in the catalyst layer and the gas diffusion layer, and (iii) an electrolyte-phase flow zone in the electrolyte membrane. The mist flow model and the two-flow model are applied to single-phase and two-phase flow zones, respectively. The model employed in this research focuses on water management that balances membrane dehydration with electrode flooding. From the simulation results, it can be concluded that the optimal operating conditions are the inlet humidification level of 100 % anode and 50 % cathode at 70℃ and the anode and cathode inlet stoichiometry ratio of 1.8 at 1.5 A/cm2 reference current density.