

Bimodal Porous/Wetting Gas Diffusion Layer of Polymer Electrolyte Membrane Fuel Cell

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A Polymer Electrolyte Membrane Fuel cell (PEMFC) is one of promising alternative energy sources for a renewable energy and environmental future. However, its performance is limited by poor reactant and product transport at the cathode side as excessive amount of produced water filling the pores of gas diffusion layer (GDL), especially at a low temperature operation and high current density. In this work, the GDL is optimally designed using bimodal porosity and water wettability for optimal water management and enhanced gaseous fuel transport for enhanced performance. In bimodal porosity, the liquid water preferentially flows through large local porosity (low capillary pressure), whereas the gaseous reactant flows through small local porosity. In bimodal wettability, the liquid water favorably flows through the hydrophilic area, while the gaseous reactant flows through the hydrophobic regions. In the bimodal porous GDL and bimodal wettability, the favorable water transport through the large local porosity and hydrophilic area are successfully demonstrated using ex-situ X-ray microtomography imaging technique. The on-going studies are demonstrated using both the various ex-situ experiments and computational models using Comsol Multiphysics.

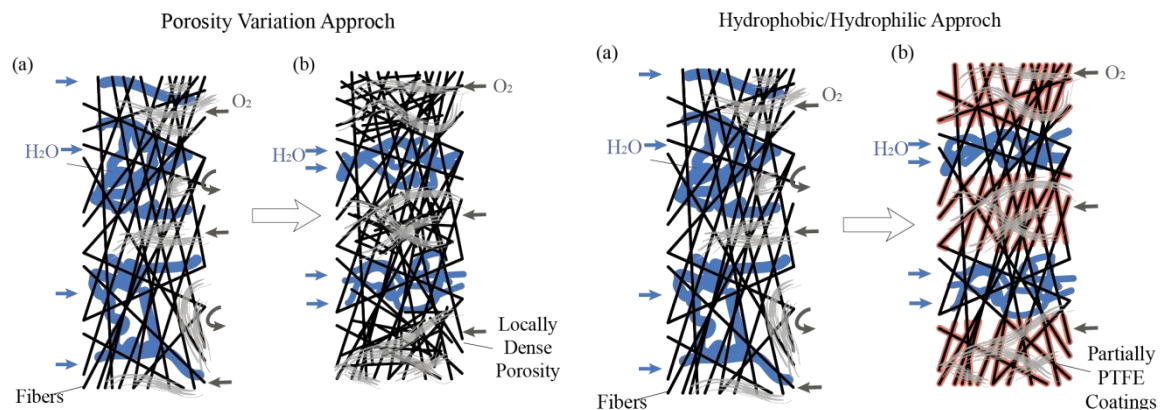


Figure 1 Schematic of the a) uniform-porous and b) bimodal porous GDL

Figure 2 Schematic of the a) uniform-wetting and b) bimodal wetting GDL