Water Management Strategies in a Proton Exchange Membrane Fuel Cell

정치영[1], 김태현[1], 김지형[2], 이성철[1,2,*]
[1]한양대학교 화학공학과; [2]한양대학교 수소연료전지공학과
(scyi@hanyang.ac.kr*)

In a proton exchange membrane fuel cell (PEMFC), water management has been regarded as the most important issue. Nafion electrolyte must be hydrated to preserve high proton conductivity, while liquid water flooding need to be minimized to mitigate mass transport limitation. Cathode flooding may be more severed during cell operation due to electro-osmotic drag (EOD) and liquid water generation by oxygen reduction reaction (ORR). On the other hand, anode flooding may arise at open circuit potential and cause serious fuel starvation and carbon corrosion situations. To mitigate both mass transport limitation in cell polarization and long-term degradation, proper water management strategy is significant. In this paper, a two-dimensional, non-isothermal, computational fluid dynamics (CFD) model is implemented by commercial CFD package, Fluent®. Water transport, generation or depletion by convection, diffusion, ORR, EOD and direct oxidation of hydrogen and oxygen are include in the present model. Various situations involving microporous layer (MPL) and gas crossover are investigated. Consequently, optimized design of MPL and membrane electrode assembly and operating conditions are suggested to avoid serious dehydration or flooding.