Investigation of process conditions on the cell performance of PEMFC

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Proton exchange membrane fuel cells(PEMFCs), as one of the most promising next-generation energy sources, have been extensively exploited by many experimenters and accounted for theoretically by analysts. In this study, three dimensional numerical simulations for PEMFC, incorporating mass transport, momentum transport, energy transport, and electrochemical kinetics have been scrutinized throughout a single cell. This theoretical consideration provides interesting characteristics of state variables inside the cell such as fluid dynamics, reactions, and heat and water generations. Simulations results on the polarization curves with different relative humidity conditions have corroborated experimental ones previously reported in Jung et al, Journal of Power Sources (2006). Also, numerical analysis for different single cells has been performed for investigating the effect of channel geometry. It has been found that by systematically controlling overpotentials, local water flooding, material properties, etc. inside the cell, the strategy for improving the performance and the efficiency on fuel cells can be established.