고온형 고분자전해질 연료전지의 준3차원 모델링을 통한 국부적 동특성 해석에 관한 연구

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A Study on the Local Dynamic Characteristics of High Temperature Proton Exchange Membrane Fuel Cell by Quasi-three-dimensional Model

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High temperature proton exchange membrane fuel cell (HT-PEMFC) has been regarded as a promising clean energy sources. In this study, a quasi-three-dimensional dynamic model of HT-PEMFC has been developed and the local dynamic characteristics are investigated. The model has the geometrical simplification of 2+1D reduction (quasi-3D). The one-dimensional model consists of nine control volumes in cross-sectional direction to solve the energy conservation and the species conservation equations. Then, the one-dimensional model is discretized into 25 local sections along the gas flow direction to account for gas and thermal transport in channels. With this discretization, the local characteristics of HT-PEMFC such as species conservation, temperature, and current density can be captured. In order to study the basic characteristics of HT-PEMFC, it is important to investigate the local dynamic characteristics. Thus, the model is simulated at various operating conditions and the local dynamic characteristics related to them are observed. The model is useful to investigate the distribution of HT-PEMFC characteristics and the physical phenomena in HT-PEMFC.

Key words : High temperature(고온형), Polybenzimidazole(폴리벤지미다졸), Proton Exchange Membrane Fuel Cell (고분자전해질형연료전지), Modeling(모델링)

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미세다공층의 침투깊이가 다른 기체확산층이 고분자전해질 연료전지의 성능과 내구성에 미치는 영향에 관한 연구

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Study on Performance and Durability of the Proton Exchange Membrane Fuel Cell with Different Micro Porous Layer Penetration Thickness

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The gas diffusion layer (GDL) consists of two main parts, the GDL backing layer, called as a substrate and the micro porous layer (MPL) coated on the GDBL. In this process, carbon particles of MPL penetrates to the GDBL consequently forms MPL penetration part. In this study, the micro porous layer (MPL) penetration thickness is determined as a design parameter of the GDL which affect pore size distribution profile through the GDL inducing different mass transfer characteristics. The pore size distribution and water permeability characteristics of the GDL are investigated and the cell performance is evaluated under fully/low humidification conditions. Transient response and voltage instability are also studied. In addition, to determine the effects of MPL penetration on the degradation, the carbon corrosion stress test is conducted. The GDL that have deep MPL penetration thickness shows better performance in high current density region because of enhanced water management, however, loss of penetrated MPL parts is shown after aging and it induces worse water management characteristics.

Key words : Proton Exchange Membrane Fuel Cell(고분자전해질형 연료전지), Gas Diffusion Layer(기체확산층), Durabillity(내구성), Penetration Thickness(침투깊이)

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