제어로직 검증 및 운전원 훈련용 연료전지 시뮬레이터

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A Fuel Cell Simulator for Control Logic Verification and Operator Training

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This research presents a fuel cell simulator for control logic verification and operator training. Nowadays, power industries are focusing on clean energy as a response to new policy. The fuel cell can be the solution for clean energy, but operating technology is not well developed compared to other conventional power plans because of its short history. Therefore we need a simulator to verify the new control strategy and train operators, because the price of a real fuel cell system is too high and mechanically weak to be used for these kind of purposes. To develop the simulator, a 300 KW MCFC(Molten Carbonate Fuel Cell) system was modeled with stack, BOPs(pre-reformer, steam generator, etc) and mechanical components(valves, pipes, pumps, blowers, etc). The process model was integrated to emulated control system and HMI(Human Machine Interface). A static load and open loop tests were conducted for verifying the accuracy of the process model, since it is the most important part in the simulation. After verifying the process model, an automatic load change and start-up tests were conducted to verify the performance of a new control strategy(logic and functional loops).

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Key words : Fuel Cell(연료전지), Simulator(시뮬레이터), OTS(운전원 훈련용 시뮬레이터), Control Logic(제어로직), HMI(운전원 화면)

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Sulfonated poly(ether sulfone)을 함유한 고분자 전해질 연료전지용 기체 확산 전극에 관한 연구

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Gas diffusion electrode containing sulfonated poly(ether sulfone) as ionomer for polymer electrolyte fuel cells

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Polymer electrolyte fuel cells (PEFCs) have received a lot of attention as a power source for both stationary and mobile applications due to their attractive feature. In general, the performance of PEFCs is highly affected by the property of the electrodes. A PEFC electrode essentially consists of a gas diffusion layer and a catalyst layer. The gas difusion layer is highly porous and hydrophobicized with PTFE polymer. The catalyst layer usually contains electrocatalyst, proton conducting polymer, even PTFE as additive. Particularly, the proton conducting ionomer helps to increase the catalytic activity at three-phase boundary and catalyst utilization. Futhermore, it helps to retain moisture, resulting in preventing the electrodes from membrane dehydration. The most widely used proton conducting ionomer is perfluorinated sulfonic acid polymer, namely, Nafion from DuPont due to its high proton conductivity and good mechanical property. However, there are great demands for alternative ionomers based on non-fluorinated materials in terms of high temperature availability, environmental adaptability and production cost.

In this study, the electrodes with the various content of the sulfonated poly(ether sulfone) ionomer in the catalyst layer were prepared. In addition, we evaluated electrochemical properties of the prepared electrodes containing the various amount of the ionomers by using the cyclic voltammetry and impedance spectroscopy to find an optimal ionomer composition in the catalyst layer.

Key words : Sulfonated poly(ether sulfone) ionomer, Polymer electrolyte fuel cell(고분자 전해질 연료전지), Gas diffusion electrode(기체 확산 전극)

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