The effect of Nafion® ionomer content/distribution and relative humidities on PEMFC performances of MEAs prepared by a CCM spraying method

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For commercial applications, MEA development must be optimized in order to achieve high performance and low cost. There are many factors that affect the performance of MEA. Especially, the optimization of the method for preparing catalyst layer has great effect on the performance of MEA. Various methods have been used to prepare the catalyst layer of MEA. Among them, spraying method has a merit in that catalysis lay can be prepared with very flexible changes in catalyst layer as well as in the solvent composition of catalyst ink. In addition, in order to reduce the time required for manufacturing catalyst layer, an effort has been made to change the nozzle size and injection pressure of spray system. Further, the operation condition of spray system was changed in various ways in an effort to prepare optimum catalyst layer of MEA. Having optimized the operation condition of spraying system, comprehensive and diverse experiments were carried out concerning various factors that affect the performance of MEA. The present research report describes the results of more sub-categorized and more detailed experiments about the important factors (Nafion® ionomer, Relative humidity) which have been shown in previous experiments to exert greater effect on the performance of MEA.

Key words : Polymer electrolyte membrane fuel cell(PEMFC, 고분자 전해질막 연료전지), MEA(막전극 접합체), Nafion® ionomer(나피온 이오노머), Catalyst coated membrane(CCM)

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캐스캐이드형 연료전지 모듈 벤트 로직 최적화

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Optimization of Vent Logic for Cascade Type Fuel Cell Module

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Many type of fuel cell stacks have been developed to improve the efficiency of reactants usage. The cascade type fuel cell stack using dead end operation is able to attain above 99% usage of hydrogen and oxygen. It is sectionalized to several parts and the residual reactants which are used previous parts would be supplied again to next parts which have less number of cells in dead end operation stack. The oversupply of reactants which is usually 120%~150% of the theoretical amount to generate current for preventing the flooding effect could be provided to each part except the last one. The final section which is called monitoring cells is supposed to be supplied insufficient the fuel or oxidant that would have some accumulated inert gas from former parts. It makes some voltage drop in the part and the fresh reactants must be supplied to the part for recovering it by venting the residual gas. So the usage of fuel and oxidant is depend on the time and frequency of opening valves for venting of residual gas and it is important to optimize the vent logic for achieving higher usage of hydrogen and oxygen. In this research, many experiments are performed to find optimal condition by evaluating the effect of time and frequency under several power conditions using over 100kW class fuel cell module. And the characteristics of the monitoring cells are studied to know the proper cell voltage which decide the condition of opening the vent valve for stable performance of the cascade type fuel cell module.

Key words : Fuel Cell(연료전지), Optimization(최적화), Cascade(캐스캐이드), Logic(로직)

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