

## 고효율 가압형 고분자 전해질 연료전지 셀스택 개발

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### Development of a High Efficiency Polymer Electrolyte Membrane Fuel Cell Stack under Pressurized Operating Conditions

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A high efficiency polymer electrolyte membrane (PEM) fuel cell stack was developed for pressurized pure hydrogen and oxygen supplying conditions. The design objective for the cell stack was to maximize the electric efficiency and to minimize exhaust-gas emissions from it simultaneously. To achieve this objective, the cell stack was designed to use pure hydrogen and oxygen as fuel and oxidant, respectively, and to be operated under high gas inlet pressures and in a stage-wise dead-end operation mode. Major components constituting the cell stack, such as membrane electrode assembly, bipolar-plate, and gasket, have been developed to meet a target durability even in severe operating conditions: high gas inlet pressures and usage of pure oxygen. A high-power fuel cell stack was assembled using these components to verify the performance. The cell stack showed a good performance in terms of the efficiency and maximum power output.

**Key words** : 고분자 전해질 연료전지(PEM Fuel Cell), 셀스택(Cell Stack), 스택설계(Stack Design), 스택 평가(Stack Evaluation)

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## 직접메탄올 연료전지의 농도 및 온도변화에 따른 실험적 검증

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### Experimental Validation of a Direct Methanol Fuel Cells(DMFCs) model with a Operating Temperatures and Methanol Feed Concentrations

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In this paper, both theoretical and experimental investigations have been performed to examine the effects of key operating parameters on the cell performance of a DMFCs (i.e., methanol feed concentration and operating temperature). For experiment, the membrane electrode assemblies (MEAs) were prepared using a conventional MEA fabrication method based on a catalyst coated electrode (CCE) and tested under various cell temperatures and methanol feed concentrations. The polarization curve measurements were conducted using in-house-made 25 cm<sup>2</sup> MEAs. The voltage-current density data were collected under three different cell temperatures (50°C, 60°C, and 70°C) and four different methanol feed concentrations (1 M, 2 M, 3 M, and 4 M). The experimental data indicate that the measured I-V curves are significantly altered, depending on these conditions. On the other hand, previously developed one-dimensional, two-phase DMFC model is simulated under the same operating conditions used in the experiments. The model predictions compare well with the experimental data over a wide range of these operating conditions, which demonstrates the validity and accuracy of the present DMFC model. Furthermore, both simulation and experimental results exhibit the strong influences of methanol and water crossover rates through the membrane on DMFC performance and I-V curve characteristics.

**Key words** : Direct Methanol Fuel Cells(직접메탄올연료전지), Membrane-Electrode Assembly(막-전극 접합체), Model validation(모델 검증)