5kW급 고분자전해질 연료전지 시스템 실증연구

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Field study of 5kW class PEMFC system

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The residential Fuel Cell system has high efficiency of 85% with transferring natural gas to electrical power and heat, directly and it is a friendly environmental new technology in that CO_2 emission can reduce 40% compared with conventional power generator and boiler. The residential fuel cell system consists of two main parts which have electrical and hot storage units. The electrical unit contains a fuel processor, a stack, an inverter, a control unit and balance of plant(BOP), and the cogeneration unit has heat exchanger, hot water tank, and auxiliaries. 5kW class fuel process was developed and tested from 2009, it was evaluated for long-term durability and reliability test including with improvement in optimal operation logic. Stack development was crried out through improvement of design and evaluation protocol. Development of system controller was successfully accomplished through strenuous efforts and original control logic was optimized in 5kW class PEMFC system. In addition, we have been focused on development of system process and assembly technology, which bring about excellent improvement of reliability of system. The 5kW class PEMFC system was operated under dynamic conditions for 1,000 hours and it showed a good performance of total efficiency and durability.

Key words : 5kW class Fuel cell system, PEMFC, Fuel processor, Stack, Inverter, BOP

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연료전지용 연료승압블로어 내부유동장 평가

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Internal Flow Analysis on the Fuel Cell's Blower

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This paper describes internal flow of a fuel cell's blower, which is mainly used for detached house and apartment. Test blower is operated by a diaphragm, which has suction and discharge port on the top of the blower. For analyzing the internal flow of the blower, three-dimensional Navier-Stokes analysis is introduced in the present study. Hybrid grid system consisted of hexa hedral, tetra hedral and prism mesh is adopted to describe the complex geometry of the diaphragm blower. Throughout the numerical simulation, it is found that the present numerical modeling for analyzing the internal flow of the test blower is suitable for understanding the unsteady nature inside the cavity of the diaphragm. Detailed unsteady flow is analyzed using the results obtained by numerical simulation.

1kW급 가정용 연료전지 블로어는 다이어프램방식에 의해 고압 및 일정유량의 가스를 이송시키는 역할을 하고 있다. 본 연구에서는 연료전지 중 연료승압블로어를 대상으로 흡입 및 토출시의 다이어프램 캐비티(Cavity) 내의 공기유동 특성을 수치해석을 적용하여 평가하였다.

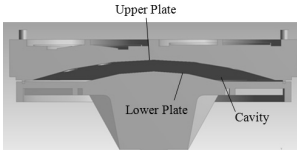


Fig. 1 Sectional view of cavity

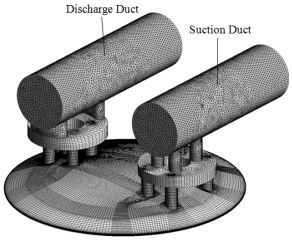
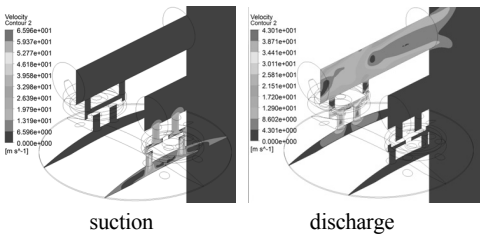


Fig. 2 Computational grid



suction discharge

Fig. 3 Velocity at suction and discharge stage

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Key words : Diaphragm blower(다이어프램 블로어), Fuel cell(연료전지), Numerical simulation(수치해석), Blower performance curve(블로어 성능곡선)

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