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IMPROVEMENT OF PERFORMANCE OF POLYMER ELECTROLYTE FUEL CELL USING NEW GAS CHANNEL WITH MICRO-GROOVES

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Abstract

Many problems remain for further improvement of the PEFC performance and popularization of PEFCs, although the polymer electrolyte fuel cells (PEFCs) have become commercially available. The control of water behaviors in PEFC is closely related to cell performance. In the range of high current density, water generated accumulates in gas diffusion layer (GDL) and in gas channels at cathode-side, and the excess water is resistant for oxygen transfer. The cell performance considerably decreases by blocking the oxygen transfer. To enhance the cell performance, it is necessary to remove effectively the water generated. In this study, in order to improve the water control in gas channels, novel gas channel with micro-grooves, which are manufactured inside channel walls, is applied. The generated water from GDL is removed through the micro-grooves to facing-side of gas channel by the forces of capillary and shearing acted by air flow. The performance of the PEFC with and without micro-grooves was examined in various experimental conditions. Therefore, the cell performance was examined by changing the cell temperature, relative humidity of gas and air velocity. It was shown that the PEFC with micro-grooves showed higher performance than the conventional PEFC without grooves. In particular, value of current density increased by approximately 23% when the air velocity was 8.0 m/s.