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The effect of through plane pore gradient GDL on the water distribution of PEMFC

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ABSTRACT

The effect of through plane pore gradient of gas diffusion layer (GDL) on the performance of Polymer Electrolyte Membrane Fuel Cell is investigated experimentally. The performance with GDLs having no, medium and high pore gradient are compared at 2 different relative humidity (RH) conditions. The medium pore gradient GDL shows generally the best performance in both RH conditions. The performance difference is analyzed based on the water distribution. The water distribution is measured through the X-ray visualization. The amount of water is reduced with the pore gradient GDL. This change reduces the concentration over-potential, and thereby increases the performance at high RH condition. However, the reduction of liquid water results in dehydration of the membrane at low RH condition. This makes lower performance with high pore gradient. The highest performance is not matched with the highest pore gradient. The effect of pore gradient is distinct when water exists sufficiently.

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Introduction

Polymer Electrolyte Membrane Fuel Cell (PEMFC) uses a polymer membrane as an electrolyte, therefore it operates at lower temperature than other fuel cells. This low operating temperature makes unique characteristic. Water which is the byproduct of fuel cell exists as gas phase generally. However, the low operating temperature of PEMFC makes water exist as liquid phase. Actually, this liquid water is essential for the operating of PEMFC, because the proton cannot pass through the membrane without water. So the sufficient liquid water saturation in membrane is required for the PEMFC. However, the liquid water has a negative effect when it gets into the gas

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