Electrical conductivity in the through-thickness direction of the carbon composite bipolar plate for the PEMFC

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ABSTRACT

PEMFC (polymer electrolyte membrane fuel cell or proton exchange membrane fuel cell) is composed of bipolar plates, end plates, MEAs (membrane electrode assembly), and GDLs (gas diffusion layer). Among them, the bipolar plate is a key component which collects and conducts the current from cell to cell. The resistance of the bipolar plate consists of bulk material resistance and interfacial contact resistance between the GDL and the bipolar plate.

In this study, the bipolar plate was developed using continuous carbon fiber reinforced composites. The electrical conductivity in the through-thickness direction of the composites, which is the most important property of the bipolar plate, was measured with respect to the stacking sequence and fabric type of fibers such as unidirectional and woven fabric. In the case of the woven fabric type carbon composite, the bulk material conductivity was high compared to the unidirectional carbon fiber reinforced composite because the carbon fibers provide the conducting channels from the top to bottom surfaces in the through-thickness direction. Also, the bulk conductivity models with respect to the fabric types were developed and compared with the experimental results.

Keywords: PEMFC, Electrical conductivity, Through-thickness direction, Carbon composite