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# A New Method for Optimal fabrication of Carbon Composite Paper as Gas Diffusion Layer Used in Proton Exchange Membrane of Fuel Cells

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## Abstract

Carbon Papers (CPs) have been widely used as a Gas Diffusion Layer (GDL) for high performance fuel cells. Herein we report a novel method for production of GDL, without the need to carbonization and graphitization steps that is common steps in GDL production. CP is provided by a dry-laying of carbon fibers (CFs) and expanded graphite (EG) in the phenolic resin and the composites are compared with carbon paper of Toray Co., Ltd. The effect of paper thickness, aspect ratio of CF and EG value of the composite are investigated. The characterizations are performed by scanning electron microscope, maximum pore size, mean pore size, permeability, electrical conductivity, flexibility, and performance (I-V) curve. The results shown that in the optimized state of the composition in the manufactured composite, the values of mean pore size, permeability, electrical conductivity, and performance curve is reasonable and near the Toray paper, however the manufactured composite show a much higher flexibility than that of Toray paper in a qualitative test. In addition, due to removing the graphitization and carbonization steps for production of carbon paper, the produced carbon paper costs are much lower than Toray paper.

**Key words:** Polymer/Carbon composite; Electrical conductivity; Gas diffusion layer; PEM fuel cell; Permeability

## 1. Introduction

In recent years, various researches have been done to utilize various energy sources such as sunlight, wind, fossil fuels, etc. in engineering applications[1-3]. The fuel cell is a power generation module that converts the chemical energy stored in the fuels and oxidants directly into power using a non-burning electrochemical reaction[4]. Among the various fuel cells, the proton exchange membrane fuel cell (PEMFC) possesses advantages such as non-polluting, non-erosion, high power, high energy conversion efficiency, fast activation and low working

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