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Improved water management of Pt/C cathode modified by graphitized carbon nanofiber in proton exchange membrane fuel cell

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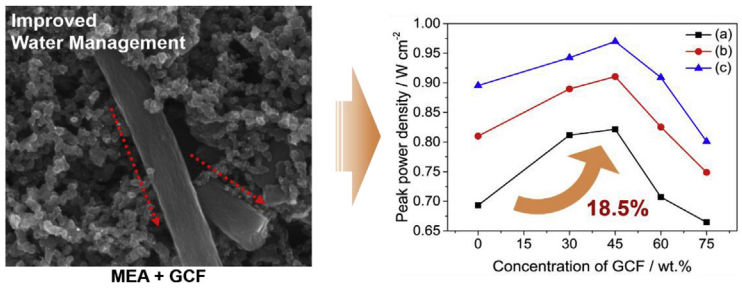
HIGHLIGHTS

- Fabrication of highly graphitized carbon nanofiber (GCF) via the annealing at 2500 °C.
- The hydrophobic GCF providing water-free spaces and improved oxygen and water transport.
- MEA with GCF showing improved fuel cell performance in mass transfer limitation region.

GRAPHICAL ABSTRACT



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ABSTRACT

Water management in the cathode is one of the most significant issues in proton exchange membrane fuel cells, especially for long-term stability and dynamic operation in fuel cell vehicles. Therefore, it is critical to design a water-managed/well-fueled cathode layer to overcome significant mass transfer limitations and the corrosion of the carbon support in fuel cells. In this work, we report a simple modification method of the Pt/C cathode using highly graphitized carbon nanofibers for improved water management. Among the graphitized carbon nanofibers with different annealing temperatures, the most hydrophobic one which is prepared by annealing at 2500 °C extremely enhances the power performance, especially at high current densities. Based on the systematical analysis, we can conclude that the graphitized carbon nanofibers act as a gas transport pathway in the cathode layer of membrane electrode assemblies. This study may open up new possibilities for water management and will be helpful for developing high performing proton exchange membrane fuel cell.

1. Introduction

Proton exchange membrane fuel cells (PEMFCs) are regarded as a promising power source with the advantages of high power density for fuel cell vehicles (FCVs). Even though it has been developed through many researches, we still face several technique issues. In particular, it is well known that generated water at the cathode can cause water flooding which makes poor mass transport at high current densities and also attends the carbon corrosion reaction during on/off mode of PEMFC [1,2]. In addition, these both water flooding and carbon

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