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Eliminating micro-porous layer from gas diffusion electrode for use in high temperature polymer electrolyte membrane fuel cell

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Highlights

• A simple MPL-free GDE is developed for HT-PEMFC application.

• A micropore/macropore composited CL structure is formed by eliminating MPL.

• The MPL-free GDE allows easy transports of electrons and gases.

• Good CL/membrane interfacial contact is still maintained with the MPL-free GDE.

• The MPL-free GDE exhibits a high performance and durability for HT-PEMFC operation.

Abstract

In this work, we report a simple strategy to improve the performance of high temperature polymer electrolyte membrane fuel cell (HT-PEMFC) by eliminating the micro-porous layer (MPL) from its gas diffusion electrodes (GDEs). Due to the absence of liquid water and the general use of high amount of catalyst, the MPL in a HT-PEMFC system works limitedly. Contrarily, the elimination of the MPL leads to an interlaced micropore/macropore composited structure in the catalyst layer (CL), which favors gas transport and catalyst utilization, resulting

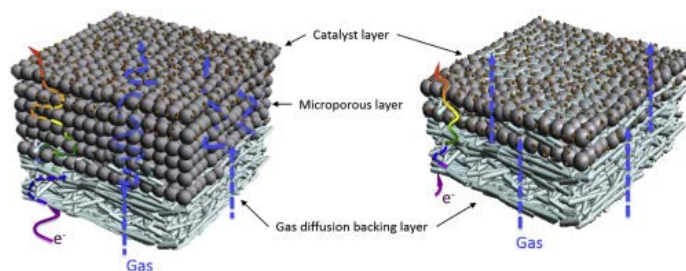
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in a greatly improved single cell performance. At the normal working voltage (0.6 V), the current density of the GDE eliminated MPL reaches 0.29 A cm^{-2} , and a maximum power density of 0.54 W cm^{-2} at 0.36 V is obtained, which are comparable to the best results yet reported for the HT-PEMFCs with similar Pt loading and operated using air. Furthermore, the MPL-free GDE maintains an excellent durability during a preliminary 1400 h HT-PEMFC operation, owing to its structure advantages, indicating the feasibility of this electrode for practical applications.

Graphical abstract



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Keywords

High temperature polymer electrolyte membrane fuel cell; Membrane electrode assembly; Gas diffusion electrode; Microporous layer; Catalyst layer

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