



Fast stack activation procedure and effective long-term storage for high-performance polymer electrolyte membrane fuel cell



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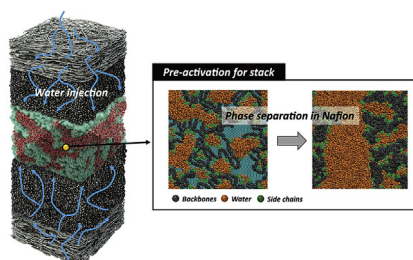
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HIGHLIGHTS

- Time-saving stack activation and long-term storage for PEMFC were investigated.
- The pre-activation by using DI water significantly reduces a whole activation time.
- The humidified N₂ gas minimizes the Pt oxidation and drying of polymer membrane.

GRAPHICAL ABSTRACT



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ABSTRACT

Time-saving stack activation and effective long-term storage are one of most important issues that must be resolved for the commercialization of polymer electrolyte membrane fuel cell (PEMFC). Herein, we developed the cost-effective stack activation method to finish the whole activation within 30 min and the long-term storage method by using humidified N₂ without any significant decrease in cell's performance for 30 days. Specifically, the pre-activation step with the direct injection of DI water into the stack and storage at 65 or 80 °C for 2 h increases the distinctive phase separation between the hydrophobic and hydrophilic regions in Nafion membrane, which significantly reduces the total activation time within 30 min. Additionally, the long-term storage with humidified N₂ has no effect on the Pt oxidation and drying of Nafion membrane for 30 days due to its exergonic reaction in the cell. As a result, the high water content in Nafion membrane and the decrease of Pt oxidation are the critical factors that have a strong influence on the activation and long-term storage for high-performance PEMFC.

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1. Introduction

The worldwide demand for the dramatic reduction of greenhouse gas emissions resulting from the use of fossil fuels has generated extensive interest in the possible use of polymer electrolyte membrane fuel cells (PEMFCs) as a clean and highly-efficient source of electric power for stationary and portable

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