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摘要: At ambient temperature, the startup capability and performance of polymer electrolyte membrane fuel cell (PEMFC) deteriorate markedly. The object of this work is to study the degradation mechanism of key components of PEMFC,—membrane electrode assembly (MEA) and seek feasible measures to avoid degradation. The effect of freeze/thaw cycles on the structure of MEA is investigated based on porosity and SEM measurement. The performance of a single cell was also tested before and after repetitious freeze/thaw cycles. The experimental results indicated that the performance of a PEMFC decreased along with the total operating time as well as the pore size distribution shifting and micro configuration changing. However, when the redundant water had been removed by gas purging, the performance of the PEMFC stack was almost resumed when it experienced again the same subzero temperature test. These results show that it is necessary to remove the water in PEMFCs to maintain stable performance under subzero temperature and gas purging is proved to be the effective operation.

引擎词: polymer electrolyte membrane fuel cell (PEMFC), freeze/thaw cycle, electrode structure, performance degradation, gas purging.

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Effects of freeze/thaw cycle and gas purging method on polymer electrolyte membrane fuel cells

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Abstract At ambient temperature, the startup capability and performance of polymer electrolyte membrane fuel cell (PEMFC) deteriorate markedly. The object of this work is to study the degradation mechanism of key components of PEMFC,—membrane electrode assembly (MEA) and seek feasible measures to avoid degradation. The effect of freeze/thaw cycles on the structure of MEA is investigated based on porosity and SEM measurement. The performance of a single cell was also tested before and after repetitious freeze/thaw cycles. The experimental results indicated that the performance of a PEMFC decreased along with the total operating time as well as the pore size distribution shifting and micro configuration changing. However, when the redundant water had been removed by gas purging, the performance of the PEMFC stack was almost resumed when it experienced again the same subzero temperature test. These results show that it is necessary to remove the water in PEMFCs to maintain stable performance under subzero temperature and gas purging is proved to be the effective operation.

Key words polymer electrolyte membrane fuel cell (PEMFC), freeze/thaw cycle, electrode structure, performance degradation, gas purging.

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