Effects of purging gas during freeze-thaw cycling on the performance degradation of direct methanol fuel cell

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Freeze-thaw cycles were used to investigate performance degradation in direct methanol fuel cells (DMFC). The freeze-thaw cycles were carried out across the temperature range of -32°C to 60°C. The details of the performance degradation were analyzed by comparing the change of polarization of each electrode and the electrochemical impedance spectrum according to the number of freeze-thaw cycles. Different purging methods before freezing were adopted, namely the cathode purge and the anode-cathode purge, to reduce any performance degradation caused by the freeze-thaw cycles. The cells purged by nitrogen gas were found to have less performance loss than the cells that were not purged during the freeze-thaw cycles. The changes in the cell resistance and the cathode electrochemical surface areas were also smaller when the cells were purged compared with those cells that were not purged. The introduction of air purging had similar positive influences with nitrogen purging on the performance of the DMFCs.