Improvement of Long-term Performance Stability of Molten Carbonate Fuel Cell Using ZrO_2 ALD Coated Cathode

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Molten carbonate fuel cell (MCFC) is a high-temperature fuel cell for power plants. Since MCFC is operated at above 600 ℃, an inexpensive catalyst can be used instead of Pt, but the lifetime of MCFC is limited due to the degradation of components. The cathode of MCFC has a porous structure for contacting gas and electrolyte. The reaction sites are reduced by grain growth and Ni dissolution during long-term operation. Therefore, to improve the long-term performance stability of MCFC, a coating to the cathode surface is proposed with preventing the grain growth and the Ni dissolution. In this study, a ZrO_2 coated cathode was fabricated by atomic layer deposition to improve the long-term performance stability of MCFC. To verify the effect of ZrO_2 coating on the performance, a single cell was fabricated with an uncoated cathode and a ZrO_2 coated cathode, respectively, and operated for about 2,000 hours at 600 ℃ with a current density of 150 mA/cm^2. During operation, the cell using the ZrO_2 coated cathode coated shows a more stable performance than the cell using the uncoated cathode. It is also confirmed that the degradation rate of cell performance is dramatically decreased.