Performance and Aging Study of a Proton Exchange Membrane with Different Materials at Different Temperatures and Humidities

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By changing the material for a membrane electrode assembly (MEA) of a fuel cell and controlling the mode of gas inflow, along with the working temperature and humidity, the performance change of the fuel cell and the aging of the MEA under low humidity were studied. It was found that with the decrease of humidity from 100% RH to 50% RH, the decline of cell performance ranged from 8.4% to 64%. Due to the hydrophilicity of silicon dioxide (SiO₂), the addition of SiO₂ into the MEA helped the membrane have better water retention; the current density greatly increased with a decline of cell performance that ranged from 17% to 44% at 50% RH. After the area of the MEA was increased, it was found that with a decrease of relative humidity, the performance decreased by 21% - 36%. Under 100% RH and after a 100-h cyclic dynamic load aging test, the performance decline of fuel cells was 27.2% and the performance decline of the ECSA was 33.3%. Under 50% RH, the performance decline of fuel cells was 51.8% and the ECSA decrease was 55.3%. The impedance increase and the fluctuating decrease of the OCV of fuel cells under 100% RH were obviously less than those under 50% RH.

Keywords: Humidity; Silicon Dioxide; Membrane Aging; Performance Decline

FULL TEXT

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