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High Temperature Electrolyte Membrane Properties of MEA with Nafion and CSPPSU Membranes by Decal Method

C. Membranes for energy and the environment

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Abstract

PEMWE has been commercialized with fluorinated electrolytes as proton-exchange polymer electrolyte membranes, platinum as the catalyst electrode for the hydrogen evolution reaction for the cathode, and iridium (iridium oxide) and ruthenium (ruthenium oxide) with excellent oxygen evolution activity for the anode. However, research and development is continuing to reduce the cost of materials and to achieve higher performance and larger size in the system. High temperature operation (100-200°C) is expected to increase the efficiency of the system by improving the activity of the catalytic electrode and the conductivity of the electrolyte membrane due to the kinetic and thermodynamic advantages of the catalytic electrode and by reducing the interfacial resistance between the electrolyte membrane and the catalytic electrode, thereby reducing the overall overvoltage of the cell.

In this presentation, membrane electrode assembly (MEAs) were fabricated by the decal method using Nafion115 or CSPPSU membranes and catalysts coated on PTFE sheets. The water electrolysis characteristics were investigated using a self-made water electrolysis apparatus from 80°C to 150°C.

The WU and conductivity of the Nafion115 and CSPPSU membranes were 38%, 47mS/cm (80°C, RH90%) and 37%, 12mS/cm (80°C, RH90%), respectively. The anode and cathode side electrodes (S=1cm^2) were prepared by applying IrO_2 (1 mg/cm^2) and Pt/C (I/C=1) (Pt=1 mg/cm^2) on PTFE sheets, respectively. The MEA was prepared by transferring the catalyst onto the membrane by hot pressing at 165°C or lower for 10 minutes. The cells were serpentine type, and the anode side was platinum coated. The anode supply water temperature was 80°C. Water supply

rate is 2 ml/min. IV measurements were evaluated while increasing the Oven temperature from 80°C to 150°C. The characteristics of MEAs with Nafion115 and CSPPSU membranes showed an increase in current density and a decrease in membrane resistance and interface resistance with increasing cell temperature. The IV performance of the cell with CSPPSU membrane was comparable to that of the cell with Nafion115 membrane. These results suggest that CSPPSU membranes, which have a higher glass transition temperature than Nafion membranes, are expected to be applied to high-temperature water electrolysis.

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References

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