Hydrogen Production by water Electrolysis with an Ultrathin Anion-exchange membrane (AEM)

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A new ultrathin anion exchange membrane (AEM) is proposed for low cost AEM electrolysis. The advantages that thin membranes offer include reduced mass transport resistance and ohmic resistance. A membrane electrode assembly (MEA) with a thinner membrane will have improved hydroxide ion transfer due to the shorter ion transfer pathway. We fabricated a MEA with a commercially available ultrathin A-901 membrane (9 µm thick) and non-noble metal catalysts. We determined the efficiency and stability of this ultrathin membrane using electrochemical impedance spectroscopy. The best performance recorded was 400 mA cm$^{-2}$ at 1.94 V at 50 $^\circ$C. Over a period of 200 h, the voltage increase was only 200 µV h$^{-1}$, which is <60% that of the more commonly used A-201 membrane. The ultrathin A-901 membrane exhibited slightly higher performance compared to the A-201 for a given catalyst, catalyst loading, and electrolyte concentration. Acta 3030® (CuCoO$_x$) and Acta 4030® (Ni/(CeO$_2$-La$_2$O$_3$)/C) were employed as the oxygen evolution reaction and hydrogen evolution reaction catalysts, respectively.

**Keywords:** A-901 AEM membranes, A-201 AEM membranes, Membrane electrode assembly, Oxygen evolution reaction, Hydrogen evolution reaction, Electrochemical impedance spectroscopy.

FULL TEXT

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