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 °C. Over a period of 200 h, the voltage increase was only $200 \mu\text{V h}^{-1}$, 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[®] ($\text{Ni}/(\text{CeO}_2\text{-La}_2\text{O}_3)/\text{C}$) 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.

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