

353g Electro-Osmotic Transport of Water through Nafion-112 Membrane

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Nafion-membrane is used as a proton exchange membrane (PEM) in fuel cells. According to recent studies on PEM fuel cells their performance is decreased when ammonia is contained in the feed gas, but it can be restored reversibly by eliminating ammonia from the gas. Nafion membrane has side chains terminating in sulfonic acid dissociative groups in its pores. In the case where such dissociative groups contact an aqueous solution, electric double layers may be formed in the membrane pores, and an electro-osmotic flow is generated by applying an electric field across the membrane. In this study, we have measured flow rates of water across Nafion-112 membrane in the presence of NH_3 , NaOH or KOH by applying DC voltage. We observed that electro-osmotic flow occurred through the membrane, and the flow rate varied in proportion to the difference in the electric potential applied across the membrane. The electro-osmotic flow rate was increased with the increasing of the solution pH without showing any appreciable dependency on the cation substance, NH_4^+ , Na^+ or K^+ in the solution. In PEM fuel cells, proton transfer takes place from anode to cathode through the pores of the membrane to generate electric power, and the generation of electricity forms an electric field across the membrane. Hence the proton transfer is likely to be retarded by the electro-osmotic flow induced by the electric field, which degrades the performance of PEM fuel cells.