Development of highly conductive and alkaline stable anion exchange membranes for alkaline fuel cell applications: polymer backbone and conducting head group approach

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Anion exchange membrane-based alkaline fuel cells (AEMAFCs) have recently gained significant attention as a viable technology that can overcome the limitations of proton exchange membrane-based fuel cells (PEMFCs). It is essential, however, to develop new AEM materials that can overcome the low levels of OH^- conductivity and poor alkaline stability displayed by currently available AEMs. Despite numerous studies, molecular design rules have not yet been fully elucidated for the development of highly conductive and alkaline-stable AEMs.

In this work, we report systematic approaches to develop highly conductive and alkaline stable anion exchange membranes. Various polymer backbones and OH^- conductors are developed, and the effects of various OH^- conductors and polymers on the properties of AEMs, including their conductivity, water content, physicochemical stability, and fuel cell device performance have been thoroughly investigated. Furthermore, by combining both experimental and simulation approaches, we set out to determine the predominant OH^- conduction mechanism for each of the different conductors under different conditions.

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