Sulfonation of Poly(phenylene oxide) Anion Exchange Membrane for All Vanadium Flow Redox Battery

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To develop a low cost non-fluorinated membrane for vanadium redox flow battery (VRFB), several commercial ion exchange membranes (IEM) were compared in terms of primary properties such as ion exchange capacity (*IEC*), vanadium ion permeability (*P*) and water transfer (*WT*) and chemical stability, and an anion exchange membrane (AEM) DF-a (based on Poly(phenylene oxide) polymers) was sulfonated into amphoteric ion exchange membranes (DF-a1 and DF-a2) to restrain *WT*. Effects of sulfonation on morphologies, selective proton conductivity (σ), *WT* and chemical stability of membranes were investigated. The results showed that sulfonation can improve *IEC*, σ , *Selectivity* and chemical stability of the AEM (DF-a). Due to Donnan effect, DF-a2 had a more dramatic reduction in *WT* and self discharge in VRFB than DF-a. Cell test showed that the membrane DF-a2 had higher coulombic efficiency (*CE*) and energy efficiency (*EE*) than DF-a and DF-a1, possessing a better potential application in VRFB.

Keywords: Amphoteric membrane; Sulfonation; Vanadium permeability; Water transfer; Vanadium redox flow battery

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