Development of Anion-Exchange Membrane Based on the Cross-Lingked Poly(Vinyl Chloride) for Non-Aqueous Vanadium Redox Flow Battery

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***Abstract*:** *Vanadium redox flow battery (VRFB) has received considerable attention in recent years due to its flexibility in design and its facility to regenerate the electrolyte solution. As one of the key components of VRFB, ion-exchange membrane should be used to prevent cross mixing of the positive and negative electrolytes, and allow the transport of ions to complete the circuit during the passage of current. Therefore, the ideal ion exchange membrane for VRFB should have high ion conductivity, low permeability of vanadium ions, and good stability. On the other hand, the poly(vinyl chloride), PVC, is one of the most popular plastic materials in the world. The PVC is a low cost polymer with good chemical and mechanical properties, which make it a suitable material for fabrication of membranes. Its structure is very interesting because PVC has the poly(ethylene) main chain and chloride side chain. Therefore, we selected PVC as base materials because the quaternary amine site could be easily introduced onto PVC polymers via substitution reaction, cross-linked reaction. The cross linked PVC with quaternary amine group may be dissolved in organic electrolyte.*

In this study, we synthesized anion-exchange membranes based on PVC as a base polymer by the solvent casting method after the substitution reaction of PVC with 1,4-bis(imidazol-1-ylmethyl)benzene in cyclohexanone, respectively. Then characteristics, such as ionic conductivity (S/cm), water uptake (%), ion-exchange capacity (meq/g), and thermal stability, of the prepared anion-exchange membranes were determined. The structure of the prepared membrane also was evaluated via Scanning Electron Microscopy (SEM) and X-ray Photoelectron Spectroscopy (XPS). The battery experiment using the prepared anion-exchange membranes in organic electrolytes was also exhibited. From battery performance results, the prepared anion-exchange membrane can be used as membrane in non-aqueous VRFB.

Keywords: *anion-exchange membrane, Vanadium redox flow battery, non-aqueous*