Preparation of Composite Anion-Exchange Membrane with Poly(3,3'-(Hexyl)Bis(1-Vinylimidazolium) Bromide) and Poly(Vinyl Chloride) for Organic Vanadium Redox Flow Battery

Young-Seok Kim and Seong-Ho Choi*
Department of Chemistry, Hannam University, Daejeon 305-811, Republic of Korea

***Abstract*:** *The vanadium redox flow battery (VRFB) is a promising electrochemical energy storage system because of high power density, various storage system and considerable energy efficiency. So, VRFBs are applied at renewable energy storage such as sunlight, wind, and etc. because of these advantages of VRFB. Among them, the electrical energy in aqueous VRFB is generated by redox reaction of V^{+2}/V^{+3} and VO^{2+}/VO_2^{+} redox couples in sulfuric acid solution as negative and positive electrolyte, respectively, that is separated by an ion exchange membrane. However, there are disadvantages in aqueous VRFBs such as dissimilar redox couple, using sulfuric acid and limit potential window of water. While the non-aqueous VRFBs are introduced the compatible redox couples and supporting electrolyte in the organic solvents. In this case the commercial ion-exchange membranes exhibited the poor chemical and mechanical stability due to organic solution swell effects. However, there are no ion-exchange membrane with good chemical stability to organic solvents for non-aqueous VRFBs until now to our knowledge.*

In this study, we prepared the composite anion-exchange membrane containing poly(3,3'-(hexyl)bis(1-vinylimidazolium) bromide) and polyvinyl chloride by solvent casting method in order to use non-aqueous VRFB membrane. We used PVC as based materials because of high chemical stability to organic solvent and easy making the membrane. Here, we also prepared the poly(3,3'-(hexyl)bis(1-vinylimidazolium) bromide) by thermal polymerization after synthesis of 3,3'-(hexyl)bis(1-vinylimidazolium) bromide by quarternization reaction. The prepared composite membrane was characterized such as chemical structure, physical, mechanical and electrochemical properties. As results, the prepared composite membrane can be used as non-aqueous membrane in organic solvents.

Keywords: *anion-exchange membrane, organic vanadium redox flow battery, poly(3,3'-(hexyl)bis(1-vinylimidazolium) bromide), poly(vinyl chloride)*