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Anion-exchange membrane with highly cross-linking and high ion-aggregation for non-aqueous vanadium redox flow batteries

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The Non-aqueous Vanadium Redox Flow Battery (NVRFB) has the advantage of being able to operate at a higher cell voltage, higher energy density, and wider temperature than the all-Vanadium Redox Flow Battery (VRFB). However, the development of NVRFB is still in its early stages of research and remains a challenge to be solved before it can be successfully applied to practical applications. One of the challenges is the ion exchange membrane, a key element in determining the energy efficiency of battery. Ion exchange membranes in NVRFB systems are mainly anion-exchange membranes to prevent permeability of metal cationic active species and serve to conduct BF_4- or PF_6- ions. However, due to the size of BF_4- or PF6- ions, ionic conductivity is low because of ion size, which limits battery efficiency. Therefore, the novel anion-exchange membrane with large size ion channel must for NVRFB be developed in order to commercialize. In this study, anion-exchange membranes were synthesized by inducing ionic aggregation by introducing crosslinking and ion exchanger simultaneously. It is believed that the aggregation of the ion exchanger through crosslinking will have a high ionic conductivity by forming an ion channel and the use of butyl reagent as a crosslinking agent will prevent crossover of energy storage material due to their size. As evidence, NVRFBs single cell with this crosslinked membranes yielded high voltage efficiency and showed a tendency to increase coulombic efficiency as the degree of crosslinking increased.

Biography

Hu-Geun Kwon has completed his Bachelor's degree from Hannam University, Republic of Korea and currently pursuing his Master's degree from Hannam University. He has studied ion-exchange membrane for non-aqueous redox flow batteries. His current research interests are crosslinked polymer electrolyte membrane for non-aqueous/aqueous redox flow batteries and anion exchange membrane fuel cell including ion transport phenomena.

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