

Modulation of the water cluster size of Nafion Membrane for high performance Zinc Bromine redox flow battery

김리율, 육성민, 이주혁, 최찬용, 김수현, 허지윤, 김희탁[†]
KAIST
(heetak.kim@kaist.ac.kr[†])

Due to its cation transport ability, Nafion membranes have been widely used in many electrochemical device as a typical cation exchange membrane. This work presents that the size of the ion exchange channel in Nafion membrane changes depending on pretreatment and how it affects the bi-ionic transport property for Nafion membrane. The expansion of water clusters with increasing pre-hydration temperature was verified by small angle X-ray scattering, diffusion cell, and electrochemical analysis. This results in the increases of water uptake, ionic conductivity and anion transference number. The bi-ionic transport and low area specific resistance induced by the pretreatment enable successful operation of Zn/Br flow batteries with NRE212 membrane. A properly treated Nafion membrane shows 11.3% higher energy efficiency compared with a conventional porous membrane, indicating that dense structured ion exchange membrane can be employed for Zn/Br flow batteries with scaling the water cluster size.