

The Performance Analysis Study of Vanadium Redox
Flow Battery Influenced by Critical Properties of Ion
Exchange Membrane

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Redox Flow Batteries(RFBs) are one of the promising candidates as an energy storage technology. As a renewable energy such as solar and wind ones is gaining attention for an alternative one to the fossil fuel, a large-scale energy storage system is becoming an essential factor in the related industry. RFBs are beneficially used in a large scale due to their own safety, long-lifespan and economical advantage. There are several types of RFB under development, each employing different redox couples. One of the most popular types is the all-vanadium redox battery(VRFB), which has been developed by many institutes and companies.

The big challenges of VRFB commercialization are to reduce production cost and to optimize its overall system. Among the key materials, ion exchange membrane(IEM) is organic semi-permeable separator that is exposed to a strong acid environment. Therefore, the lifespan of IEM mainly influence the lifetime of the overall VRFB system. The cost of ion exchange membrane takes up 30% of the cost of the stack. So, optimal development or selection of IEM is very important to secure the competitiveness of a VRFB system.

In this study, the basic research work of IEM was performed with critical properties of membrane. Three critical properties which influence performance of VRFB are selected to area resistance, ion exchange capacity and permeability of membrane. With various types of membrane, the effects of critical properties of membrane on the VRFB performance were studied. The optimal criteria of membrane property have been derived through the analysis of experimental results. Findings of this study can be used to develop low cost IEM and to select a proper of IEM of VRFB.