ETFE-BASED POLYMER ELECTROLYTE MEMBRANES FOR VANADIUM REDOX FLOW BATTERIES

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Redox flow batteries gained large interest for energy storage, in particular with respect to fluctuating energy production. Most commonly vanadium redox flow batteries (VRFB) are used. The performance of these batteries is strongly affected by the polymer electrolyte membrane (PEM), which separates the electrochemical cells. While Nafion is used as PEM material in most applications, due to several shortcomings various approaches are followed to find alternate membranes. Some challenges are the electrochemical performance, the chemical and mechanical stability as well as cross-over of electrolyte material and water. In our research we pursue radiation-induced activation of polymer films and subsequent graft copolymerization. In this contribution the preparation of PEMs in a three step process is reported: Firstly, commercially available fluoropolymer films, e.g., poly(ethylene-co-tetrafluoroethylene) (ETFE), are activated via electron beam treatment. Secondly, graft copolymerizations with functional methacrylates are performed. After sulfonation of the functional groups the final PEM is obtained. The impact of the ETFE activation process and the polymerization conditions on the PEM performance are addressed. In order to reduce cross-over in vanadium redox flow batteries the polymerizations may be carried out in the presence of crosslinking monomers. The electrical performance of the resulting PEMs is evaluated by VRFB tests. Up to 300 charge and discharge cycles were carried out, lasting for nearly a month. Stable electrochemical performance directly indicates membrane stability under typical VRFB conditions [1].

[1] X. Li, A. R. dos Santos, M. Drache, X. Ke, U. Gohs, T. Turek, M. Becker, U. Kunz, S. Beuermann, *J. Membr. Sci.* **2017**, *524*, 419