# Accepted Manuscript


Effect of grafting of poly(styrenesulfonate) onto Nafion membrane on the performance of vanadium redox flow battery

Ming-Chien Yang, Chien-Hong Lin, Jong-Tar Kuo, Hwa-Jou Wei

PII: S1572-6657(17)30812-3
DOI: doi:10.1016/j.jelechem.2017.11.034
Reference: JEAC 3664

To appear in: *Journal of Electroanalytical Chemistry*

Received date: 17 January 2017
Revised date: 30 October 2017
Accepted date: 11 November 2017

Please cite this article as: Ming-Chien Yang, Chien-Hong Lin, Jong-Tar Kuo, Hwa-Jou Wei , Effect of grafting of poly(styrenesulfonate) onto Nafion membrane on the performance of vanadium redox flow battery. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Jeac(2017), doi:10.1016/j.jelechem.2017.11.034

# Effect of grafting of poly(styrenesulfonate) onto Nafion membrane on the performance of vanadium redox flow battery

Ming-Chien Yang[a*], Chien-Hong Lin[b], Jong-Tar Kuo[c], and Hwa-Jou Wei[b]

[a] Department of Materials Science and Engineering, National Taiwan University of Science and Technology, Taipei, Taiwan

[b] Chemistry Division, Institute of Nuclear Energy Research, Longtan, Taiwan

[c] Department of Biological Science and Technology, China University of Science and Technology, Taipei, Taiwan

## ABSTRACT

A modified membrane for vanadium redox flow battery (VRFB) was prepared by grafting sodium 4-styrenesulfonate (NaSS) to the surface of Nafion 212 via the oxygen plasma induced grafting technique to reduce the crossover of vanadium ions of the membrane. By grafting with poly(styrenesulfonic acid) (PSS), the crossover of vanadium ions through the Nafion membrane is only 32% of that of the pristine Nafion membrane. Thus, comparing with pristine Nafion membrane, the resulting Nafion-g-PSS membrane exhibits higher ion exchange capacity (IEC) and through-plane conductivity. In addition, this Nafion-g-PSS membrane improves the voltage efficiency (VE), coulombic efficiency (CE), and energy efficiency (EE) of VRFB. Owing to lower vanadium ions permeability, the VRFB with Nafion-g-PSS membrane exhibited much slower self-discharge than the VRFB with pristine Nafion 212, and the VE, CE, and EE after 200 cycles of charge-discharge test remain stable. In particular, the VRFB with Nafion-g-PSS membrane exhibits higher capacity retention than the VRFB with pristine Nafion 212 membrane.

*Keywords:* vanadium redox flow battery; Nafion membrane; graft polymerization; sodium styrenesulfonate; vanadium permeability

* Corresponding Author. E-mail: myang@mail.ntust.edu.tw