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**Sulfonated poly(ether ether ketone)-based hybrid membranes containing polydopamine-decorated multiwalled carbon nanotubes with acid-base pairs for all vanadium redox flow battery**

Yuxia Zhang, Haixia Wang, Wenkai Yu, Jingli Shi and Haifeng Shi\*

State Key Laboratory of Separation Membranes and Membrane Processes, Tianjin Key Laboratory of Advanced Fiber and Energy Storage, School of Materials Science and Engineering, Tianjin Polytechnic University, Tianjin 300387, China

\* To whom should be corresponded. E-mail: haifeng.shi@gmail.com (H. Shi)

**Abstract**

Sulfonated poly(ether ether ketone) (SPEEK) hybrid membranes containing polydopamine-decorated multiwalled carbon nanotubes (MWCNTs@PDA) as the interfacial modifier have been fabricated. The membrane structure and physicochemical properties such as water uptake, swelling ratio, proton conductivity and vanadium ion permeability of SPEEK hybrid membranes are evaluated by XPS, TG, SEM, TEM and single-cell apparatus. The deposited mass percentage of PDA layer onto MWCNTs and the loaded contents of MWCNTs@PDA nanofillers into SPEEK membrane are detailed discussed. A 33 wt% PDA decorated MWCNTs offers a good membrane performance. In the single cell performance test, SPEEK/MWCNTs@PDA-1 hybrid membrane shows a higher coulombic efficiency (CE: 94.7%) and energy efficiency (EE: 85.9%), and a longer self-discharge time (55 h) against Nafion 117 membrane (23 h) is illustrated. A 100-time charging-discharging cycle indicates a good chemical stability of SPEEK/MWCNTs@PDA-1 hybrid membrane, which is ascribed to the formed acid-base interaction. The durability for SPEEK hybrid membranes need to be enhanced for VRB application.

**Keywords:**

Vanadium redox flow battery; Polydopamine-decorated multiwalled carbon nanotubes;

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