Adhesive, partially fluorinated, microphase-separated comb copolymer electrolyte membranes for solid flexible supercapacitors

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Solid electrolytes with high safety and good flexibility have attracted great interest as an alternative to conventional liquid electrolytes which suffer flammability and leakage problems. Herein, we report a free-standing solid electrolyte membrane based on a partially fluorinated, microphase-separated comb copolymer consisting of superhydrophobic poly(2,2,2-trifluoroethyl methacrylate) and amphiphilic crystalline poly(ethylene glycol) behenyl ether methacrylate. The comb copolymer electrolyte with ionic liquid (IL) exhibited a wide potential window of 2.2 V and retained its excellent flexibility up to 85 wt% IL loading. The comb copolymer electrolyte with improved ionic conductivity was achieved due to the self-assembled ionic channel. The solid supercapacitor based on the comb copolymer electrolyte showed a high specific capacitance (37.3 F g^{-1}), energy density (23.2 Wh kg^{-1}), and power density (530 W kg^{-1}). In addition, the fabrication of supercapacitors did not require any separator, adhesive, or packaging process because of the self-adhesive, non-volatile, and mechanical properties of the comb copolymer electrolyte membranes.

Reference

S. J. Moon, H. J. Min, C. S. Lee, D. R. Kang, J. H. Kim, Chemical Engineering Journal 2022, 429, 132240