PAMPS/PVA/MMT Semi-Interpenetrating Polymer Network Hydrogel Electrolyte for Solid-State Supercapacitors

Jin Wang*, Hucheng Chen, Yahui Xiao, Xianghu Yu, Xiaoxuan Li

Anhui Province Key Laboratory of Advanced Functional Materials and Devices, School of Chemistry and Chemical Engineering, Hefei University of Technology, Hefei 23009, P. R. China

*E-mail: jinwang@hfut.edu.cn

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Polyelectrolyte hydrogels have great potential as gel-polymer electrolytes (GPE) because of their low-cost and environmental benefits. Here a polyelectrolyte hydrogel of high ionic conductivities and mechanical properties was developed via the formation of semi-interpenetrating polymer network (s-IPN) GPE, which consists of Poly (2-acrylamide-2-methyl propane sulfonic acid) (PAMPS), poly(vinyl alcohol) (PVA) and sodium montmorillonite(MMT). The additions of MMT and PVA can both increase the ionic conductivities and the tensile strength of PAMPS. PAMPS/PVA/MMT s-IPN GPE show excellent overall performance of ionic conductivity of $6.4 \times 10^{-2} \text{ S cm}^{-1}$ and tensile strength of 24.3 MPa when the ratio of PVA/AMPS is at 0.8:1 and MMT is at 7wt%. When PAMPS/PVA/MMT s-IPN is used as a GPE in supercapacitors, it exhibits good electrolyte behavior with its specific capacitance of 208 F g⁻¹, close to that of using 4M KOH aqueous solution electrolyte.

Keywords: hydrogel electrolyte, semi-interpenetrating, ionic conductivity, supercapacitors, Poly (2-acrylamide-2-methyl propane sulfonic acid)

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