Application of Zwitterionic Solid Polymer Electrolytes in Improving the Performance of Lithium Metal Batteries

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Abstract:

In this study, poly(ethylene glycol) methyl ether methacrylate was used as the main electrolyte substrate, and was prepared with sulfobetaine methacrylate (SBMA) as the precursor. The non-woven cellulose fiber was dip-coated with sulfonated poly (ether ketone) (sPEEK) to prepare the sPEEK-coated cellulose separator. Then, the zwitterionic solid polymer electrolyte was fabricated with the sPEEK-coated cellulose and the precursor by in-situ polymerization. The ionic conductivity was improved by using the sPEEK-coated cellulose separator. However, the porosity of the separator was decreased as the amount of sPEEK coating on the cellulose was increased. The battery assembled with sPEEK-coated cellulose separator made of proper amounts of sPEEK solution and liquid electrolyte had good performance. In the solid-sate electrolyte, the zwitterionic SBMA on side chains of the copolymer could assist lithium salts dissociation and lithium ion transport through ion-dipole interactions. The electrolyte containing a suitable amount of SBMA had high ionic conductivity and lithium transference number. The polarization near the lithium electrode was reduced, and a stable passivation layer was formed on the electrode surface. In addition, SBMA in the electrolyte lowered the cathode interfacial impedance. The results showed that the zwitterionic solid polymer electrolyte had good battery performance and cycle stability.