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Single Ion Conductors for Lithium-Ion Battery Application

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Abstract : Next generation lithium batteries are taking more attention and single-ion polymer electrolytes are expected to play a significant role in the development of these kinds of energy storage systems. In the present work we used a different strategy to design of novel solid single-ion conducting inorganic polymer electrolytes based on lithium polyvinyl alcohol oxalate borate (Li(PVAOB), lithium polyacrylic acid oxalate borate (LiPAAOB) and poly (ethylene glycol) methacrylate (PEGMA). Free radical polymerization was used to convert PEGMA into PPEGMA and LiPAAOB is prepared from poly (acrylic acid), oxalic acid and boric acid. Blend polymer electrolytes were produced by mixing of LiPAAOB or Li (PVAOB with PPEGMA at different stoichiometric ratios to enhance the single ion conductivity of the systems. To exploit the flexible chemistry and increase the segmental mobility of the blend electrolyte, the composition was changed up to 80% with respect to the guest polymer, PPEGMA. FT-IR and differential scanning calorimeter techniques confirmed the interaction between the host and guest polymers. TGA verified that the thermal stability of the blends increased up to approximately 200 C. Scanning electron microscopy images confirm the homogeneity of the blend electrolytes. CV studies showed that electrochemical stability electrochemical stability window is approximately 5 V versus Li/Li^+. The effect of PPEGMA on to the Lithium-ion conductivity was investigated using dielectric impedance analyzer. The maximum single ion conductivity was measured as 1.3×10^{-4} S/cm at 100 C for the sample LiPAAOB-80PPEGMA. Clearly, the results confirmed the positive effect to the increment in ionic conductivity of the blend electrolytes with the addition of PPEGMA.

Keywords : single-ion conductor, inorganic polymer, blends, polymer electrolyte
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