Dry, PEO-based polymer electrolytes with a novel, LiBOB, lithium salt.

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The Poly(ethylene oxide), PEO, - lithium salt, LiX, complexes[1] may find practical application as electrolyte separators in secondary lithium polymer batteries. The ionic conductivity occurs in the amorphous regions of the electrolyte membrane[2], since the PEO local relaxation and the segmental motion are fundamental requirements for lithium ion transport. Such conditions are reached above 70°C, where the PEO electrolyte membranes show an appreciable conductivity (> 10^{-4} Scm^{-1}). Large research efforts were devoted to lowering the operating temperature of (PEO)-based polymer electrolytes. An useful approach is the use of a very large anion salt which is able to interfere with the crystallization process[3-5], thus promoting amorphous regions inside the PEO host[1,3,5,6].

Following this approach, $LiB(C_2O_4)_2$, Lithium-Bis(Oxalato)Borate (LiBOB) was used as lithium salt for PEO-based polymer electrolytes. LiBOB exhibits a high chemical stability due the absence of $-CF_3$ groups or atoms, such as fluoride, and it is thermally stable up to 300°C. Therefore, this salt is expected to form stable complexes with the PEO polymer. Various $P(EO)_nLiBOB$ electrolyte compositions were prepared through a completely dry, solvent-free procedure by hot-pressing. This allowed to obtain homogeneous membranes having very good mechanical properties and an elastomeric, rubber-like appearance at room temperature. The structure and the thermal behavior of the polymer samples were investigated by X-ray diffraction (XRD) and differential scanning calorimetry (DSC), respectively. The ionic conductivity was evaluated by impedance spectroscopy as a function of the temperature and of the EO/Li molar ratio. Finally, selected $P(EO)_nLiBOB$ membranes were employed as separator in lithium polymer batteries. Preliminary cycling tests were performed on the cells at different current densities and temperatures. The results are reported and discussed in this work.

References

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