A STUDY OF ELECTRICAL CONDUCTIVITY OF PEO-X SOLID POLYMER ELECTROLYTES WITH X = $LiCF_3SO_3$, $ZnC_7H_5O_3$ AND PbI_2

L.R.A.K. BANDARA, A.M.S.B. ABEYKOON, R.S.P. BOKALAWELA AND M.A.K.L. DISSANAYAKE

Department of Physics, Faculty of Science, University of Peradeniya

Solid polymer electrolytes occupy a unique position in the development of a new generation of power source applications ranging from small portable electronic equipment to larger electric vehicles. These polymers, in thin film form, display many advantages over liquid electrolytes such as leakage proof and gassing. Further, they show dual action both as ionic conductors and mechanical separators, which make them the most attractive solid polymer electrolyte in conducting polymer-based batteries.

A wide range of salts can be dissolved in poly(ethylene oxide) (PEO) to form solid polymer electrolytes whose transport ions may be cations or anions. In this work, PEO based electrolyte films with three types of salts, namely lithium triflorosulfonate ($LiCF_3SO_3$), zinc salizelate ($ZnC_7H_5O_3$) and lead iodide (PbI_2) were used and their electrical conductivity measurements were carried out. Samples have been prepared by the solvent casting technique. The complex impedance measurements were performed over the frequency range of 5 Hz to13 MHz, using a computer controlled HP4192A impedance analyzer with an applied signal of 0.1 V. The impedance data were collected in the temperature range of 25 °C to 85 °C. DC polarization test was carried out on all the samples, using both the blocking and non blocking electrodes, to estimate the tranfrerency numbers of the polymer electrolytes.

Compared to the other two systems, PEO-$LiCF_3SO_3$ system shows higher ionic conductivities. With both $ZnC_7H_5O_3$ and PbI_2 salts, PEO based solid polymer electrolytes show almost the same conductivity values within the studied temperature range. In all three systems, the ionic conductivity increases linearly with increasing temperature. The knee observed in these conductivity curves are assumed to be due to the melting of the crystalline phase of pure PEO. It was observed that the ionic conductivity is high in the amorphous phase above 55 °C, in the presence of a flexible polymer chain. Results of the dc polarization test showed that all the studied samples had low electronic conductivities. According to the above results, PEO-$LiCF_3SO_3$ and PEO-$ZnC_7H_5O_3$ systems can be mainly considered as cationic conductors while the PEO-PbI_2 system acts as anionic conductors.

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