ELECTRICAL CONDUCTIVITY ENHANCEMENT IN PEO-BASED POLYMER ELECTROLYTES CONTAINING MIXED-SALTS $LiCF_3SO_3$ AND $NiCl_2$

K.VIGNAROOBAN, M.A.K.L.DISSANAYAKE* AND R.S.P.BOKALAWELA

Department of Physics, Faculty of Science and Postgraduate Institute of Science
University of Peradeniya

Poly(ethylene oxide), (PEO)-based polymer electrolytes are receiving attention as potential candidates to be used as electrolyte membranes in lithium polymer batteries and other devices. However, their low ionic conductivity at ambient temperatures considerably limits their usage. According to the literature, several routes have been used to enhance the room temperature ionic conductivity of PEO based electrolytes. Among them, the complexing of PEO with two salts has shown some positive results. However, only a limited number of reports on such systems can be found in the literature. In this paper, we report the conductivity enhancement in the PEO_9 LiTf system due to the incorporation of $NiCl_2$ as the second complexing salt.

Polymer electrolyte samples were prepared using the standard solvent casting technique. Thermal characterization was done by using the Perkin Elmer Pyris 1, Differential Scanning Calorimeter. Ionic conductivity was measured by using the Schlumberger 1260 Impedance Analyzer.

The results show that the addition of 10 wt% of $NiCl_2$ to PEO_9 LiTf has given rise to the maximum conductivity enhancement. The conductivity of PEO_9 LiTf at 25 ^{0}C is 3.63×10^{-7} S cm^{-1} and the conductivity of the sample incorporating 10 wt% $NiCl_2$ is 1.50×10^{-6} S cm^{-1} at the same temperature. Our attempts to further enhance the ionic conductivity of this system by the addition of nano-sized Al_2O_3 filler has yielded negative results.

The discontinuity in the log σ vs 1/T plots around 60 ^{0}C has diminished considerably for the 10 wt% $NiCl_2$ composition indicating that a higher fraction of the amorphous phase is retained due to the presence of $NiCl_2$ at this composition. This is quite likely be the reason for the enhanced conductivity.

The topological disorder of the polymer chain, brought about by the mixed-salt system appears to give rise to a more extensive amorphous phase and increase the ionic conductivity.

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