E1-09 Dielectric and conductivity studies of the plasticized PEO - $LiCF_3SO_3$ solid polymer electrolytes

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The addition of a high permittivity plasticizer to a polymer electrolyte will promote the dissociation of salt by reducing the degree of crystallinity and the glass transition temperature. This consequently enhances the ionic conductivity. The effect of addition of such plasticizers to the polymer electrolytes is still not completely understood and, therefore, it is important to study the dielectric behaviour of polymer electrolytes in order to describe the microscopic structure and dynamics of ionic conductivity.

Dielectric and conductivity measurements have been performed on poly(ethylene oxide) (PEO) complexes prepared by solvent casting method with $LiCF_3SO_3$ ranging in concentration from n = 9 to 2000 in the configuration of $(PEO)_nLiCF_3SO_3$. A constant amount of ethylene carbonate (EC) was added as the plasticizer to the polymer by varying salt concentrations. The complex impedance was measured using a SI 1260 impedance analyzer over a frequency range of 0.1-$3x10^7$Hz with an applied signal of 20mV from 0 to 120°C. The results were compared with the sample $(PEO)_{2000}LiCF_3SO_3$ without any plasticizer.

Addition of plasticizer increases the ionic conductivity of the PEO-$LiCF_3SO_3$ complex and retains the mechanical properties as a solid electrolyte. For example without any plasticizer the low salt concentrated sample $(PEO)_{2000}$ $LiCF_3SO_3$ complex had a conductivity of $1.4x10^{-6}$ S cm^{-1} at 333K. When only 5wt% of EC is added to this, the conductivity increased to $6.9x10^{-5}$ S cm^{-1} at the same temperature.

After substraction of the conductivity contribution, the absorption spectra show a dielectric relaxation slightly above 1 Mhz. The peak values of the corrected loss factor curves depend on the temperature and the height of the curves decreases with increasing temperature. Detected relaxation below the room temperature appears to be due to ion pairs.

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