

Optical and electrical characteristics of $(\text{LiCl})_x(\text{P}_2\text{O}_5)_{1-x}$ glass.

Abstract

Homogeneous $(\text{LiCl})_x(\text{P}_2\text{O}_5)_{1-x}$ glasses were synthesised using a melt-quenching method for $x = 0.1-0.6$ in the interval of 0.05. The amorphous structure of the samples was evident by the X-ray diffraction spectrum. The short range structures of the binary phosphate samples were examined by Fourier transform infrared spectroscopy, whilst the density of the samples was measured as supportive data for the investigations. The results of refractive indices as measured using an ellipsometer reveal the homogeneity of samples and was found to depend on the glass composition. The electrical properties of the glasses were investigated by ac impedance spectroscopy from 10 mHz to 1 MHz for temperatures ranging from room temperature to 573 K. An estimation of the bulk resistivity was obtained by taking the intercepts on the real axis at low frequencies of the complex impedance plot. The dc conductivities derived from the reciprocal of resistivity values were found to obey the Arrhenius relationship, and its activation energy shows a decreasing trend with the increase in LiCl content in the glass. Lastly, an equivalent circuits consisting of real and complex capacitors is proposed to describe the dielectric response of the glass.

Keyword: $(\text{LiCl})_x(\text{P}_2\text{O}_5)_{1-x}$ glass; FTIR; Dielectric properties; AC conductivity; Glasses; Relaxations.