Study of K⁺ ion Conductivity in the Glassy Electrolytes (100-x)(3K₂S-7P₂S₅)-xKI (x=0, 5, 10, 15 and 20)

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Abstract:

A series of glassy electrolytes with a ternary system of $(100-x)(3K_2S-7P_2S_5)$ -xKI (x=0, 5, 10, 15 and 20) are studied for their K⁺ ion conductivities by using electrochemical impedance spectroscopy (EIS). The conductivity of the compound with x = 20 is found to be the highest among the studied glassy electrolytes at ambient temperature with the value of 2.36 x 10⁻¹⁰ Scm⁻¹. The electrolytes are characterized by XRD, DSC and Raman spectroscopy. Since the glass transition temperatures of the glasses are just above 130 °C as demonstrated by DSC, temperature dependent conductivities are studied below 130 °C within the range of 21 to 125 °C to determine the activation energies. Raman Spectroscopic study shows the invariant structural units of PS_4^{3-} , PS_7^{4-} , PS_6^{4-} of the network former for different glassy electrolytes. The similarity of vibrational modes with parent composition indicates the non-interaction of halide ions with network former units and halide ions reside interstitially in the glass system. The increment of the conductivity with increasing KI addition is due to the increase in the charge carrier concentration.