EFFECT OF Al_2O_3 ON THE IONIC CONDUCTIVITY OF $Li_{2.2}S_{0.8}P_{0.2}O_4$

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$Li_{2.2}S_{0.8}P_{0.2}O_4$ has been prepared by melting appropriate quantities of Li_2SO_4 and Li_3PO_4. Ionic conductivity at various temperatures from 150 °C to 500 °C has been measured using compressed polycrystalline pellets and the complex impedance technique. The compound shows a substantially higher Li^+ ion conductivity compared to that of pure Li_2SO_4 and pure Li_3PO_4 in the temperature range studied. The ionic conductivity of the compound at 300°C is $\sim 6.0 \times 10^{-4}$ (ohm cm)$^{-1}$ whereas that of Li_2SO_4 and Li_3PO_4 at the same temperature are $\sim 4.5 \times 10^{-6}$ (ohm cm)$^{-1}$ and $\sim 3.8 \times 10^{-7}$ (ohm cm)$^{-1}$ respectively.

Addition of Al_2O_3 powder to this compound has resulted a drop in conductivity, the values being $\sim 2.8 \times 10^{-4}$ (ohm cm)$^{-1}$ and $\sim 1.5 \times 10^{-4}$ (ohm cm)$^{-1}$ at 300 °C respectively, for the two compositions 5 and 10 mole% Al_2O_3. This drop in conductivity can be attributed to the blocking effect of inert Al_2O_3 grains on Li^+ ion migration. This is in contrast to the enhancement of ionic conductivity observed when alumina powder is added to ionic solids with very low conductivity $\lesssim 10^{-6}$ (ohm cm)$^{-1}$ and caused by the composite effect. The present investigation supports the fact that the composite effect cannot enhance the ionic conductivity of solids with rather good ionic conductivity $\gtrsim 10^{-4}$ (ohm cm)$^{-1}$.

References:

Kimura, N. and Greenblett, M. (1984): Mat. Res. Bull., (19) 1653.

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