E1-04: New Li^+ ion conductors of LISICON type, $Li_{4-2x}Co_xGeO_4$, solid solutions

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There is a considerable interest in finding new Li^+ ion conducting solid electrolytes with potential applications in solid state batteries and other devices. Several studies have been made on Li^+ion conductivity in solid solutions based on low conductivity parent phases such as y-Li_3PO_4 and y-Li_2ZnGeO_4. These solid solutions contain extra mobile Li^+ ions in interstitial sites which give rise to high Li^+ ion conductivity. The first to be discovered in this family, was LISICON or $Li_{14}Zn(GeO_4)_4$ which is a solid solution in the binary system Li_4GeO_4-Li_2ZnGeO_4. It had high conductivity at high temperatures, e.g. 0.13 Scm^{-1} at 300°C.

In the present work the structure, phase equilibria and conductivity of the Li_4GeO_4-Li_2CoGeO_4. system are reported. X-ray powder diffraction was used

to establish the soild solution range and complex impedance measurement in the 100 Hz to 10 MHz range to study the conductivity variation with composition and temperature.

A new range of y-solid solutions with formula $Li_{4-2x}Co_xGeO_4$:$0.2 < x < 0.6$ was found; for $x > 0.6$ a two-phase mixture of y_{ss} and β-LI_2CoGeO_4 forms, whereas for $x < 0.2$, a range of two phase mixture of Li_4GeO_4 and y_{ss} forms. The highest conductivity of 1.3×10^{-3} Scm^{-1} at 300°C was observed for the $x = 0.3$ composition, and it was found that the conductivity was very high compared to that of LI_4GeO_4 but still lower than the conductivity of LISICON, $LI_{14}Zn(GeO_4)_4$.