14. HIGH ION CONDUCTING 3D NETWORK POLY(ETHYLENE OXIDE)

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Studies of ionic conductivity in polymers complexed with divalent or trivalent cations are useful for understanding the parameters related to conductivity in polymers. In the present work a calcium salt has been selected since it is less hygroscopic than corresponding alkaline salts when dissolved in poly (ethylene oxide) network. The polycondensation between α, ω - diol-poly (ethylene glycol), $H(OCH_2CH_2)_nOH$ with average MW 1000 and 3-chloro-2-chloromethyl-1-propane was done in the presence of excess KOH. The average molecular weight of the linear polycondensate determined by gel permeation chromatography was about 20,000. Cross-linking of linear polycondensate was done by free-radical polymerization using dibenzoyl peroxide as initiator to obtain a thin film of 3D network polymer. Membranes of 11 mm diameter were cut from the completely dried films. To prepare samples of different O/Ca ratio, calcium trifluoromethyl-sulphonate $Ca(CF_3SO_3)_2$ salt was dissolved in a small amount of acetonitrile and the membrane was put to absorb the whole solution. It was possible to prepare sample with O/Ca ratio from 8 to 100. Then the membranes were dried under vacuum at 90 °C for one day. The electrical conductivity of membranes was measured under vacuum by a complex impedance technique in the temperature range from 90 °C to room temperature. The maximum conductivity was obtained for O/Ca=25 which is about 2.0×10^{-4} S cm^{-1} at 75°C and 1.0×10^{-5} S cm^{-1} at room temperature. Polymers synthesized in this method have glass transition temperatures below room temperature and hence, give a very high ionic conductivity and have very good mechanical properties due to three dimensional links.

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