

IONIC CONDUCTIVITY STUDIES OF PEO-SILICA HYBRID GLASSES

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There has been significant growth in the field of solid-state ionics over the past 30 years. This is due to the increasing need to find suitably durable solid-state ionic conductors that can be used over a wide range of temperatures and conditions.

This work focuses on the synthesis and characterization of PEO-silica hybrid glasses that exhibit high levels of ionic conductivity, so that they may be used for solid-state electrochemical sensors, detectors, electrodes and batteries. Silica sol-gel glasses that have been functionalized with poly (ethylene oxide) units have been shown in recent literature to possess levels of ionic conductivity in the range of 10^{-5} to 10^{-4} S cm⁻¹. There is evidence that the interaction of PEO with silica gels may enhance ionic conductivity in amorphous composites.

A series of short-chained PEO-functionalized sol-gel glasses (3-4 [EO] units per chain) at various concentrations have been synthesized using TEOS as a precursor. These materials have been doped with various concentrations of LiClO₄ in order to test for specific lithium ion conductivities at varying temperatures between 5-90 °C. Thin films have been cast on platinum electrodes and measured via 4-point impedance spectroscopy on a tailored apparatus built for this purpose. The temperature dependence of the conductivity and the thermal properties of these materials have been analyzed to give insight into the mechanisms of conduction.