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" Synthesis, structural, optical and electrical characterization of Y2O3/poly(ethylene glycol)–poly(vinyl chloride) based nanocomposite solid polymer electrolytes" Polym Int 2023; 72: 342–355

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Abstract:

Nanocomposite solid polymer electrolytes (NCSPEs) have attracted a lot of attention as excellent candidates for future electronics, photonics and energy storage devices. In this work, Y2O3 (YO) nanosheets were prepared by a free-template sol–gel method and incorporated inside a poly(ethylene glycol)–poly(vinyl chloride) (blend) matrix via solution casting. NCSPE films were then prepared by adding NaClO4 (NC) or LiCl (LC) to the nanocomposite solutions. XRD and field emission SEM showed that YO has a body-centered cubic structure and a crystallite size of 24.8 nm, and looks like nanosheets with a high purity. The XRD results of the films showed that YO loading and salt complexation increase the films' amorphous structure. SEM was used to study the surface morphology and film thickness. Fourier transform infrared spectra confirmed the complexation and interactions between the YO/blend and NC or LC. UV–visible spectroscopy revealed that the films display low transmittance (<17%), an extinction coefficient k between 0.2 × 10-3 and 1 × 10-3 and a comparatively high refractive index. The band gap of the blend decreased from 4.3 to 4.0 eV on loading YO, and NC exhibited a higher impact on Eg compared with LC. A significant increase in (*σac*) with complexing was reported and the maximum value was 7.4 × 10-4 S cm-1 for the 10 wt% NC/YO/blend structure. The NCSPE films are ionic conductors and have a non-Debye type of conductivity relaxation, and the applied AC conduction mechanism is correlated barrier hopping.