S. Saber, S. El-Sayed, and Adel M. El Sayed" Influence of Eu3+ on the structural, optical and electrical properties of PEO–PVA: dual bandgap materials for optoelectronic applications" J Mater Sci: Mater Electron (2023) 34:406 DOI.org/10.1007/s10854-023-09841-6
Accepted: 5 January 2023

Published Online:4 February2023

Abstract:

Solid-polymer electrolytes (SPE) based on rare-earth doping is a growing approach for the development of various optoelectronic and ion-conducting devices. Eu3+/PEO–PVA SPE was prepared by solution casting. The impacts of Eu3+content on the microstructure, chemical composition, and complexation with the functional groups of the blend as well as on the film morphology were evaluated by X-ray diffraction, FT-IR spectroscopy, and FE-SEM microscopy. It was revealed that the film's crystallinity and optical transmittance can be tailored by Eu3? content. Tauc's method illustrated that the films exhibit dual band gaps on both the low energy side (2.0–2.8 eV) and the high energy side (4.0–4.38 eV). In addition, the refractive index and optical conductivity of SPE were greatly enhanced with increasing Eu3+ content. The current–voltage characteristic curves were recorded at an applied voltage range of 0–10 V, and temperature range of 30–100 C. The materials exhibited non-Ohmic behavior. The DC conductivity (*σdc*)values of the pure and 6 wt% Eu3+-doped blend were in the range of 1.16 * 10^{-6}–2.05 * 10^{-6} S/cm and 1.73 * 10^{-6}–3.36 * 10^{-6} S/cm, respectively. The relations between the current density and the electric field revealed that the Schottky emission is the most suitable conduction mechanism. The results indicate that Eu3?/PEO–PVA SPE is suitable for some optoelectronic applications and ion-conducting devices.