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An investigation on the abnormal trend of the conductivity properties of CMC /PVA-doped NH₄Cl-based solid biopolymer electrolyte system

(Article)

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Abstract

The present work was carried out to investigate the abnormal trend of electrochemical properties of solid biopolymer electrolytes (SBEs) system -based carboxymethyl cellulose (CMC) blended with polyvinyl alcohol (PVA)-doped NH₄Cl. The SBEs system was prepared via solution casting technique and analyzed through Fourier transform infrared (FTIR) spectroscopy, thermogravimetric analysis (TGA), X-ray diffraction (XRD) analysis, and electrical impedance spectroscopy (EIS). Complexation was observed with the changes of peaks at 1065 cm⁻¹, 1598 cm⁻¹, 2912 cm⁻¹, and 3396 cm⁻¹ that corresponds to C–O–C, C=O of COO⁻ stretching, C–H stretching, and O–H stretching, respectively, of CMC /PVA blend system upon the addition of NH₄Cl. The decrease of the amorphousness and the increase of weight loss demonstrated the abnormal observation of the ionic conductivity when (1–5 wt%) NH₄Cl was added in the SBEs system which was lower than the un-doped SBEs system. It was also observed that the highest ionic conductivity at $8.86 \times 10^{-5} \text{ Scm}^{-1}$ was achieved by the sample containing 6 wt% of NH₄Cl. The temperature dependence of the SBEs system is found to be governed by the Arrhenius rule. Through the IR deconvolution technique, the conductivity of CMC /PVA-NH₄Cl SBEs system was shown to be primarily influenced by the ionic mobility and diffusion coefficient of the ions. © 2018, Springer-Verlag GmbH Germany, part of Springer Nature.

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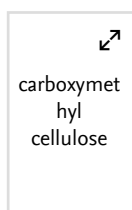
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