

Studies on the ions transportation behavior of alginate doped with H⁺ carrier-based polymer electrolytes

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ABSTRACT

In the present work, amorphous bio-based polymer electrolytes (BBPEs) using alginate polymer as a matrix host and doped with varying amounts of ammonium iodide (NH₄I) have been developed via the solution casting technique. The physicochemical properties of alginate-NH₄I BBPEs were evaluated by using X-Ray diffraction (XRD), scanning electron microscope (SEM), Fourier transform infrared (FTIR), thermal gravimetric analysis (TGA), electrical impedance spectroscopy (EIS), and transference number measurement (TNM). The BBPEs film containing 25 wt % of NH₄I possessed the highest ionic conductivity of $1.29 \times 10^{-4} \text{ S cm}^{-1}$, the highest amorphous phase, and good thermal stability of up to 234 °C. Based on the Nyquist fitting approaches, the ionic conductivity of the BBPEs was primarily influenced by the ion transportation, which was due to the interplay of segmental motion between the alginate and NH₄I, and also the H⁺ hopping mechanism, as shown by FTIR. The proton transference number ($t_{H^+} = 0.41$) suggests that alginate BBPEs are promising materials in electrochemical device applications.

KEYWORDS

Alginate; Proton (H⁺); Amorphous polymer electrolyte; Thermal stability; Ionic conductivity

ACKNOWLEDGEMENT

The authors would like to thank the Ministry of Higher Education (MOHE) of Malaysia for the Fundamental Research Grant Scheme (FRGS/1/2019/STG07/UMP/02/4), Faculty of Industrial Sciences and Technology for the research support and Universiti Malaysia Pahang for providing the Doctoral Research Scheme (DRS) and Internal Research Grant (RDU223304).