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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 × 10−4 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 (tH+ = 0.41) suggests that alginate BBPEs are promising materials in electrochemical device applications. © 2022 Elsevier B.V.

Author Keywords
alginate; Amorphous polymer electrolyte; Ionic conductivity; Proton (H+); Thermal stability

Index Keywords
Alginate, Fourier transform infrared spectroscopy, Ionic conductivity, Physicochemical properties, Polyelectrolytes, Scanning electron microscopy, Thermogravimetric analysis; Alginate polymers, Amorphous polymer electrolyte, Amorphous polymers, Bio-based polymers, Fourier transform infrared, Ion transportation, matrix, Polymer electrolyte, Proton (H+), Transference number; Thermodynamic stability

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