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Enhancement on protonation (H^+) with incorporation of flexible ethylene carbonate in CMC–PVA–30 wt % NH_4NO_3 film

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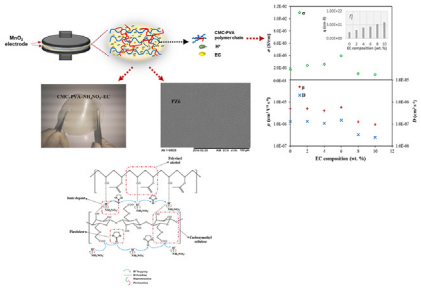
HIGHLIGHTS

- A polymer electrolytes has been prepared using CMC–PVA–NH_4NO_3 with various content of EC.
- EC substituent significantly increase the dissociation NH_4^+– NO_3 in polymer complexes.
- The H^+ ions contributes to the enhancement of ionic conductivity (~10^{-3} S/cm).
- Ionic transport via Nyquist fitting method corroborates with the trend of ionic conductivity.

GRAPHICAL ABSTRACT



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ABSTRACT

In the present work, carboxymethyl cellulose (CMC)–polyvinyl alcohol (PVA)–NH_4NO_3 with the addition of ethylene carbonate (EC) based polymer blend electrolyte (PBE) was explored. The complexes of PBE with addition of EC revealed that an interaction of the –OH and $-COO^-$ of the CMC–PVA blend with the dissociation of H^+ from NH_4NO_3 provides a flexibility pathway for ion hopping. The optimum ionic conductivity at room temperature was found to be 3.92×10^{-3} S/cm for the sample containing 6 wt.% EC with an increment of amorphous phase and thermal stability. Based on the Impedance-Nyquist theoretical approach, it was shown that the ionic conductivity with cation transference number ($t_{H^+} = 0.48$) of the PBE is primarily influenced by the ionic mobility as well as the ions diffusion coefficient. The findings verified that the CMC–PVA–NH_4NO_3

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