EFFECT OF RARE EARTH METAL OXIDES (Nd_2O_3, Sm_2O_3 and Eu_2O_3) ON PROPERTIES OF CELLULOSE BASED COMPOSITE POLYMER ELECTROLYTE

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ABSTRACT

Polymer has semi crystalline properties that makes ion difficult to move caused the SPE has low ionic conductivity. The addition of filler into polymer matrix can increase ionic conductivity. Rare earth metal as filler is less explored in the past. In this study, solid polymer electrolyte (SPE) has been prepared using carboxymethyl cellulose (CMC) as polymer host, Lithium bis-trifluoromethanesulfonimide (LiTFSI) salt as charge carrier and 10 wt.% of three different rare earth metal oxides ; Nd_2O_3, Sm_2O_3 and Eu_2O_3 as filler. SPE film samples were prepared using solution casting method and characterized by electrochemical impedance (EIS), fourier transform infrared (FTIR), x-ray diffraction (XRD) and tensile. Addition of LiTFSI salt increased ionic conductivity of CMC from 9.14019×10^{-8} S cm $^{-1}$ to 2.2409×10^{-7} S cm $^{-1}$ but incorporation of rare earth metal to CMC-LiTFSI decreased the ionic conductivity in the order of 4.01523×10^{-8} S cm^{-1} > 3.81581×10^{-8} S cm^{-1} > 2.01616×10^{-8} S cm^{-1}. FTIR proved the complexation of LiTFSI with CMC at OH and C=O sites while Nd_2O_3 and Sm_2O_3 interacted at OH site only. The ionic conductivity values were explained further with XRD result that shows the decrease in peak intensity (sample become more amorphous) with addition of LiTFSI to CMC but increase in intensity (sample become more crystalline) with addition of rare earth metal. Incorporation of rare earth metal oxides also reduced the tensile strength of SPE sample. In conclusion, the addition of rare earth metal decreased the ionic conductivity and reduced the mechanical properties of CMC-based SPE.