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Effect of $C_3H_4O_3$ on Band Gap Narrowing of Proton Conductive Hybrid Polymer Electrolyte

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Abstract

In the present work, hybrid polymer electrolyte based on carboxymethyl cellulose-polyvinyl alcohol-ammonium nitrate-ethylene carbonate (CMC–PVA–NH_4NO_3–$C_3H_4O_3$) become the promising materials that has demonstrated outstanding physical properties as an electrolytes system in solar cell. In the frame of solar cell progress, the electrical conductivity and optical bandgap of polymer electrolytes are equally explored. The characterization is carried out via electrical impedance spectroscopy (EIS) and ultraviolet visible-near infrared (UV-VIS-NIR) spectroscopy. An equivalent circuit of parallel combination, bulk resistance (R_b), and constant phase element (CPE) is obtained from transparent conductive film, CMC–PVA–NH_4NO_3–$C_3H_4O_3$. The optimum ionic conductivity is accomplished at 3.92×10^{-3} S cm^{-1} for sample containing with 6 wt.% of $C_3H_4O_3$. The absorption spectra are evaluated in the wavelength ranging from 200 to 1100 nm. Theoretical analysis reveals that the addition of 6 wt. % EC is initiating the band gap narrowing from 4.96 to 4.88 eV. The results show that the present developed materials-based polymer electrolytes have great potential for solar energy devices. © 2021 Wiley-VCH GmbH

Author keywords

hybrid polymer electrolyte ; impedance study; ionic conductivity; optical band gap

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