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Structural and electrochemical studies of proton conducting biopolymer blend electrolytes based on MC:Dextran for EDLC device application with high energy density

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Abstract

This study shows preparation and characterization of solid biopolymer electrolyte based on glycerolized methylcellulose (MC): dextran-doped with ammonium thiocyanate (NH4SCN). The nature of electrolyte composition in terms of interaction is characterized using Fourier transform infrared (FTIR) technique. Lowering and shifting in the intensity of the bands are observed with increasing the quantity of glycerol as a plasticizer, confirming complexation between electrolyte components. Ion transport parameters are determined using both of the methods of EIS and FTIR where the parameters are found to be increased with glycerol concentration. The transport number measurement indicates that ions are the primary charge carrier in the conduction mechanism where tion is found to be 0.961. The maximum DC ionic conductivity value is achieved that found to be 1.63 × 10−3 S cm−1. The ESR values are ranged from 300 to 580 Ω throughout 450 cycles. The technique of linear sweep voltammetry (LSV) shows the electrochemical stability window of 2 V for the conducting samples. The response of cyclic voltammetry (CV) shows an almost rectangular shape without Faradaic peaks. A galvanostatic charge–discharge investigation has shown the initial specific capacitance, energy density, and power density are 133 F g−1, 18.3 Wh Kg−1, and 680 W Kg−1, respectively. © 2021

Author Keywords

CV and EDLC study; Dextran; FTIR and EIS study; Methylcellulose; Polymer blend electrolyte; Transport number measurement and LSV

Index Keywords

Biomolecules, Biopolymers, Dextran, Fourier transform infrared spectroscopy, Glycerol, Nitrogen compounds, Polyelectrolytes, Solid electrolytes; Cyclic voltammetry and EDLC study, EIS studies, Fourier transform infrared, Fourier transform infrared studies, Linear sweep voltammetry, Methylcellulose, Polymer blend electrolyte, Structural studies, Transport number measurement and linear sweep voltammetry, Transport number measurements; Cyclic voltammetry

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