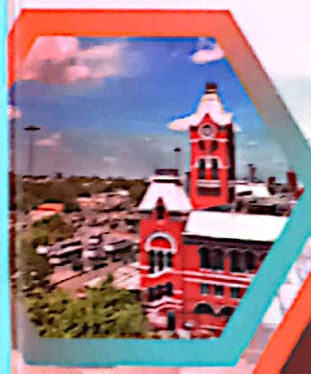

18th ASIAN CONFERENCE ON SOLID STATE IONICS

ACSSI - 2024

19th - 22nd FEBRUARY, 2024

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(Autonomous)
Kodambakkam, Chennai - 600024, India

BOOK OF ABSTRACTS

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C2-OP11

PEO and PVdF-HFP Blend Polymer, Electrospun Nanofibres Based Gel Electrolyte for Dye-sensitized Solar Cell Applications

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Abstract

The electrolyte is pivotal in dye-sensitized solar cells (DSSCs), serving to reduce oxidized dye and facilitate charge transfer. Drawbacks associated with liquid electrolytes, like leakage and electrode corrosion/dye degradation, prompted research aimed at replacing the liquid electrolyte with gel or solid polymer alternatives.

In this study, blend polymer-based nanofibre gel electrolytes were prepared using optimized composition of PEO and PVdF-HFP polymers. Specifically, 80% PVdF-HFP and 20% PEO were used, maintaining a fixed total polymer weight. The liquid electrolyte comprised propylene carbonate, tetrapropyl ammonium iodide, iodine and BMII ionic liquid. The electrospun nanofibre membranes, deposited on platinum substrates, were soaked in the liquid electrolyte for 30 minutes to allow the absorption of the electrolyte solution by the nanofiber matrix, forming a gel electrolyte. The nanofiber membrane thickness was varied by varying the electrospinning time from 1 to 7 minutes.

The best performance of DSSC was observed with the nanofibre films deposited for2 minutes time duration. Comparison among DSSCs with different electrolytes; liquid, liquid-soaked nanofibre gel, and conventional gel revealed superior power conversion efficiency (8.58%) for the nanofibre gel electrolyte, outperforming the conventional gel electrolyte (8.17%) under 100 mW cm^{-2} illumination. Devices fabricated with liquid electrolyte showed 8.82% under the same irradiation conditions. A similar trend was observed in the ionic conductivities of these three electrolytes too. SEM images revealed the formation of membranes with the thickness of 5.16 µm consisting of a three-dimensional network of polymer nanofibers, with diameters ranging between 300 to 700 nm.

Key words: Dye-sensitized solar cells, electrolyte, blend polymers, electro-spun nanofibres