Quasi-solid-state Electrolyte for Dye Sensitized Solar Cells Based on Nanofiber PMA-PVDF and PMA-PVDF / PEG Membranes

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doi: 10.20964/2016.07.19

Received: 27 March 2016 / Accepted: 17 April 2016 / Published: 4 June 2016

Novel electrospun membranes quasi-solid electrolytes based on blends of polymethylacrylate (PMA) - polyvinylidene fluoride (PVDF), and PMA-PVDF/PEG (polyethylene glycol) are prepared by electrospinning technique and applied as quasi-solid state electrolytes in dye sensitized solar cells (DSSCs). The membranes are characterized by Fourier transform infrared (FT-IR) spectrophotometer, differential scanning calorimeter (DSC), Scanning electron microscopy (SEM), and Electrochemical impedance spectroscopy. The crystallinity obtained from the DSC data increased with the increase of PVDF wt% in PMA-PVDF blend and then decreased for the PMA-PVDF/PEG membranes. The fully interconnected porous structure of the host polymer membranes of PMA-PVDF (4:6 wt%) exhibited a high electrolyte uptake reached to ~ 265% and an ionic conductivity of $2.1 \times 10^{-3} \text{ S cm}^{-1}$, which is increased to 406.3%, and $3.2 \times 10^{-3} \text{ S cm}^{-1}$, respectively for PMA-PVDF/PEG (4:6:4 wt%) membrane. DSSC is assembled by PMA-PVDF(4:6 wt%) and attained an overall energy conversion efficiency of 6.6% at light intensity of 100 mW cm^{-2} . The presence of 4 w% PEG in the electrolyte membrane increased the energy conversion efficiency to 7 % giving a promise candidate for scaling up this type of DSSCs.

Keywords: Dye sensitized solar cells, quasi solid electrolyte, electrospinning, ionic conductivity.

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