Synthesis and Characterization of Polymer Electrolytes for Dye Sensitized Solar Cells

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The search for renewable sources of energy has led to an increasing interest in photochemical cells (PECSs) because of their possible role as transducers of solar to electrical energy. PECSs fabricated with dye sensitized (DS) nanoporous films of semiconductors have been studied extensively throughout the last decade, in attempts to make efficient low cost alternatives to the silicon solar cell. Although practically viable efficiencies have achieved, the liquid electrolyte in DS PECSs presents problems which have not been resolved satisfactorily. In this context many researchers including our group have tried to replace the electrolyte with inorganic hole conductors and polymeric quasi solid electrolytes. As an continuation of that, in this study, to obtain the best, solidified polymeric electrolyte to be used in dye DS PECSs applications, the effect of solidification, crystallinty, redox couple concentration, choice of cations and additives in the solar cell performances were investigated by fabricating polymeric electrolytes Comprising with poly (acrylonitrile) (PAN) and tested them with the DS solar cells having a configuration FTO/$Ti0_2$-Ruthenium Dye/Polymer electrolyte/Pt-FTO. The best composition of the polymer electrolyte giving highest efficiency was PAN (9.98%)/EC (ethylene carbonate, 39.92%)/PC (Propylene carbonate, 39.92%)/LiI (9.98%0_2 (0.20%) (by weight) which yields on overall energy-conversion efficiency of about 4.53% under the irradiance of 100 mW cm^{-2}. The introduction of the nano sized ceramic filler TiO2 effectively enhanced the performance of the cell efficiency up to 4.80% .The morphology, structure, and conductivity studies were examined by, X-ray diffraction (XRD), FTIR and AC impedance techniques. X-ray Diffraction result has shown that the electrolytes with TiO_2 filler has an amorphous structure and no crystalline peaks were observed. The addition of TiO_2 significantly enhanced the conductivity of the electrolyte showing $5.58x10^{-3}$S cm^{-1}.

Key words: Dye sensitized solar cell, Polymer Electrolytes, poly (acrylonitrile) (PAN), FTO/$Ti0_2$-Ruthenium Dye/Polymer electrolyte/Pt-FTO, TiO_2 filler