SYNTHESIS, CHARACTERIZATION AND APPLICATIONS OF POLYETHYLENE OXIDE (PEO) BASED NANO-COMPOSITE POLYMER ELECTROLYTES AND THEIR APPLICATIONS IN DYE - SENSITIZED SOLAR CELLS

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Polyethylene oxide (PEO) based polymer electrolytes for dye-sensitized solar cells (DSSCs) and for Lithium batteries were investigated. Characterization was done using current - voltage (*I-V*) characterization, impedance spectroscopy, DC polarization, Fourier Transformed Infrared (FTIR) spectroscopy and atomic force microscopy (AFM) techniques.

First system investigated for DSSCs are based on gel polymer electrolyte PEO: KI: $Pr_4N^+I^-$: PC: TiO_2:I_2. The mixed cation effect on solar cell efficiency enhancement by using PEO based gel polymer electrolyte was investigated varying the KI: $Pr_4N^+I^-$ composition ratio. The best efficiency, 4.12 % was obtained for the sample with 75 wt. % KI concentration and the efficiency was further increased to 5.31% with the addition of 2.5 wt.% nano TiO_2. Further addition of the nano filler resulted decrease in the solar cell efficiency as well as the total ionic conductivity of the electrolyte. DC polarization measurements establish the predominantly ionic behavior of the electrolytes.

In the second system, ionic liquid was used in order to avoid the use of volatile organic solvents. However, acetonitrile (ACN) was used for better mixing purpose and was totally evaporated before electrolyte characterization. FTIR spectroscopy was used to confirm the absence of ACN traces. Incorporation of TiO_2 nano particles into the system resulted increase of solar cell efficiency by 9%. Recombination lifetime of electrons was investigated using solar cell impedance spectroscopy.

Silica nano particles synthesized from Rice Husk Ash (RHA) were characterized using FTIR and AFM techniques and were incorporated in to the PEO based solid polymer electrolyte system $(PEO)_9LiTf$ which was characterized using impedance spectroscopy. It was observed that the addition of nano-silica from RHA enhanced the ionic conductivity of the PEO based electrolyte.