



Section E1

501/E1

Fabrication of quasi–solid state dye sensitized solar cells employing titania nanotubes and 1-methyl-3-propylimidazolium iodide in PAN

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Dye Sensitized Solar Cells (DSSCs) have drawn tremendous attention during the past two decades mainly due to their cheaper fabrication cost compared to silicon based solar cells. DSSC are composed of large band gap TiO₂ nanocrystalline semiconductor nanoparticles decorated with light absorbing dye molecules on a conducting substrate (FTO: F-doped SnO₂) and a liquid electrolyte based on I⁺/I₃⁻ redox couple, sandwiched between the working electrode and Pt counter electrode. However, randomly oriented TiO₂ nanoparticles and the liquid based electrolyte in the assembly have resulted in many problems for its real time utility. Recombination of charge carriers due to random orientation of the TiO₂ nanoparticles and leakage of the electrolyte are two of the major drawbacks of the classical DSSCs. Introducing both one dimensional nanomaterials such as nanotubes for direct electron transport and solid-state electrolytes are the current interests of researchers to overcome the problems mentioned previously. Therefore, in this investigation Titania nanotubes (TNTs) and a quasi-solid-state electrolyte were employed for DSSC fabrication. TNTs were synthesized *via* hydrothermal treatment of TiO₂ nanoparticles (P25 Degussa) and two different polyacrylonitrile (PAN) based quasi-solid-state electrolytes were utilized with and without 1-methyl-3-propylimidazolium iodide (MPII). The electrolytes were prepared by heating a mixture of PAN, ethylene carbonate, propylene carbonate, tetrabutylammonium iodide, iodine and tetrabutylpyridine at 100 °C until a viscous fluid formed. Finally, DSSCs were assembled utilizing these two types of electrolytes with TNT based working electrodes. The power conversion efficiency of 4.51 % and 1.97 % were recorded at an illumination intensity of 100 m W/ cm² at AM 1.5 G for the electrolyte with and without MPII respectively and the DSSC performances are tabulated in Table 1.

Table 1. DSSC performances with quasi-solid state electrolyte with and without MPII

DSSC Parameters	V _{oc} (mV)	J _{sc} (mA/cm ²)	FF (%)	η (%)
PAN With MPII	762.9	9.0	65.5	4.51
PAN Without MPII	753.7	3.5	73.9	1.97