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Black dye sensitized quasi-solid state solar cells with PAN based electrolyte containing LiI and tetrahexylammonium iodide

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Dye-sensitized solar cells (DSSCs) are emerging as a low cost alternative device to conventional inorganic thin film solar cells. DSSCs contain a photo-anode and quasi-solid or liquid electrolyte. The photo-anodes made using nano-porous TiO_2 have shown higher efficiencies. Although DSSCs with liquid electrolytes give better efficiencies than those with quasi-solid (gel) electrolytes, DSSCs containing liquid electrolytes have some drawbacks, such as stability problems. These drawbacks can be omitted to same extent by using quasi-solid electrolytes. Even though many research articles can be found on DSSCs, to our knowledge, very few papers can be found on use of two iodide salts in gel polymer electrolytes. In this work two different iodide salts namely, Lithium iodide (LiI) and Tetrahexylammonium iodide ($HeX_4N^+I^-$) were used. These two different iodides contain comparatively small and bigger cations respectively. The quasi-solid electrolytes were prepared incorporating polyacrilonitrile (PAN), iodide salts and I_2. Ethylene carbonate (EC) and propylene carbonate (PC) were used as plasticizer. The solar cell configuration was Glass/FTO/TiO_2 with Black-dye/electrolyte/Pt/FTO /Glass. The cells were fabricated using quasi-solid electrolyte with different ratios of salts. But the total amounts of iodide salts were kept constant. The nano-porous TiO_2 photo-anode was sensitized with photosensitizer of black dye. The cell with salt ratio LiI :$HeX_4N^+I^-$1:1 showed 10.03 mA cm^{-2} of short circuit current density (J_{sc}) and 578 mV of open circuit voltage (V_{oc}) under 1000 W m^{-2} ,1.5 AM irradiation. Maximum power density of the cell was 3.45 mW cm^{-2} and the fill factor of the cell was 59.46%.

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