UTILIZATION OF CONDUCTING POLYMERS AS SENSITIZERS IN SOLID-STATE PHOTOCELLS

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Substituted thiophene sensitized, nanocrystalline TiO_2-based quasi solid-state solar cells were fabricated by using either poly (3-thiophene acetic acid) (P3TAA) or a copolymer with poly (3-thiophene acetic acid)-poly(hexylthiophene) (P3TAA-PHT) and their performances were examined. The photocells were able to generate reasonably high photocurrents in the presence of hole transporting material CuI for the first time in polymer sensitized sold-state photovoltaic devices. Dramatic enhancement in the cell performances were observed with the addition of an ionic liquid 1-ethyl-3-methylimidazolium bis(trifluromethylsulfonyl) amide ($EMImTf_2N$) and $LiTf_2N$ to the CuI solution as additives for charge transport promotion. The cell sensitized with P3TAA generated a short circuit photocurrent of ~1.4 $mAcm^{-2}$ with an open-circuit voltage of ~330 mV and a total power conversion efficiency of ~0.25% under the irradiance of 1000 Wm^{-2} (1.5 Air Mass). In the case of co-polymer P3TAA-PHT delivered ~0.28% efficiency under the same conditions with ~1.45 $mAcm^{-2}$ as photocurrent and ~325 mV as photovoltage. The corresponding incident photon to current conversion efficiencies (IPCE) of the above cells were ~37 % and ~31 %, respectively.