

PHOTORESPONSES OF COPOLYMERS BASED ON DERIVATIVES OF THIOPHENE UNITS

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ABSTRACT

Several regioregular polythiophenes were prepared and investigated for their photoresponses by fabricating solar devices based on mesoporous TiO_2 electrodes. Monomers of 3-thiophene acetic acid (3TAA), thiophene malonic acid (TMA), thiophene (T) and pyrrole (PY) were used as starting materials to obtain their regioregular polymers. The photocells were able to generate reasonably high photocurrent, which increases in the presence of electron donating ionic liquids in the electrolyte composed of the redox couple I_3^-/I^- . Dramatic enhancements in the cell performances were observed with the addition of ionic liquid 1-methyl-3-N-hexylimidazolium iodide into the electrolyte. While the cell sensitized with poly (3-thiophene acetic acid) (P3TAA) generated a short-circuit photocurrent of $\sim 4.35 \text{ mA cm}^{-2}$, an open-circuit photovoltage of $\sim 472 \text{ mV}$ and a total power conversion efficiency of $\sim 1.2\%$ under simulated sunlight of 100 mW cm^{-2} (Air Mass 1.5), the cell sensitized with regioregular polymer P3TAA-PTMA (poly (3-thiophene malonic acid)) delivered $\sim 3.29 \text{ mA cm}^{-2}$ as photocurrent and $\sim 407 \text{ mV}$ as photovoltage with $\sim 0.8\%$ efficiency under the same conditions. The corresponding values of the cells fabricated with either P3TAA-PT (polythiophene) or P3TAA-PPY (polypyrrole) were 2.25 mA cm^{-2} , $\sim 307 \text{ mV}$, 0.4% and 1.85 mA cm^{-2} , $\sim 402 \text{ mV}$, 0.4% .

Key words: *Conducting polymer dyes, mesoporous TiO_2 , Dye sensitized solar cells.*