# Polythiophene-sensitized $TiO_2$ solar cells

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**Abstract**

Polythiophene-sensitized, nanocrystalline $TiO_2$-based photoelectrochemical cells were fabricated either by using poly(3-thiophene acetic acid) (P3TAA) or a co-polymer; poly(3-thiophene acetic acid)–poly(hexyl thiophene) (P3TAA-PHT) polymers and their performances were examined. The photocells were able to generate reasonably high photocurrent, which increases in the presence of the electron-donating ionic liquids in the electrolyte composed of 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 P3TAA generated a short-circuit photocurrent of ~9.75 mA $cm^{-2}$, an open-circuit photovoltage of ~405 mV and a total power conversion efficiency of ~2.4% under simulated full sunlight of 100 mW $cm^{-2}$ (air mass 1.5) the cell sensitized with copolymer P3TAA-PHT delivered ~1.6% efficiency under the same conditions with ~7 mA $cm^{-2}$ as photocurrent and ~375 mV as photovoltage. The corresponding incident photon-to-current conversion efficiencies (IPCE) of the above cells were ~60 and ~40%, respectively.


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