Efficient charge collection in hybrid polymer/ TiO2 solar cells using poly(ethylenedioxythiophene)/polystyrene sulphonate as hole collector

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Abstract

We report a study of the optimization of power conversion efficiency in hybrid solar cells based on nanostructured titanium dioxide and a poly[2-(2-ethylhexyloxy)-5-methoxy-1,4-phenylenevinylene] (MEH-PPV) based conjugated polymer. Charge collection efficiency is enhanced by introducing a poly(ethylenedioxythiophene)/polystyrene sulphonate (PEDOT) layer (under the gold electrode) as the hole collector. Device performance is maximized for a device with a net active layer thickness of 100 nm. The optimized device has peak external quantum efficiencies ≈40% at the polymer's maximum absorption wavelength and yield short circuit current density ≥2 mA cm-2 for air mass (AM) 1.5 conditions (100 mW cm-2, 1 sun). The AM 1.5 open circuit voltage for this device is 0.64 V and the fill factor is 0.43, resulting in an overall power conversion efficiency of 0.58%.

Indexed keywords

Engineering controlled terms: Current density; Electric potential; Energy conversion; Nanostructured materials; Optimization; Polymers; Polystyrenes; Solar cells

Engineering uncontrolled terms: Hole collector; Hybrid polymers; Poly(ethylenedioxythiophene); Polystyrene sulfonate

Engineering main heading: Titanium dioxide