Effect of temperature and light intensity on the performance of polymer/fullerene solar cells with titanium dioxide nanolayers

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Abstract

In this work, alternative architecture for polymer/fullerene solar cells has been explored using titanium dioxide nanolayers which invert the polarity of the cell and may relax the necessity to have a hole-collecting buffer layer poly(styrene sulfonate)-doped poly(ethylene dioxy-thiophene) (PEDOTPSS). This work particularly focuses on the performance of the inverted devices with dense TiO_2 nanolayers as a function of temperature, illumination intensity and time. We find that both temperature and illumination intensity slightly influence the power conversion efficiency of devices with the PEDOT:PSS layer. However, the inverted solar cells without the PEDOT:PSS layer showed very different characteristics regarding the power conversion efficiency which increased significantly with the operating temperature from 30°C to 65°C. This was attributed to a consequence from the strong and positive temperature dependence of open-circuit voltage which may be due to a "kink" in the current-voltage characteristics near the open-circuit voltage.

Author keywords

Fullerene; Intensity; Polymer; Solar Cells; Temperature; Titanium Dioxide

Indexed keywords

Effect of temperature; Illumination intensity; Intensity; Inverted devices; Light intensity; Nano layers; Operating temperature; PEDOT:PSS; Poly(styrene sulfonate); Power conversion efficiencies; Temperature dependence; TiO

Engineering controlled terms: Conversion efficiency; Ethylene; Fullerenes; Open circuit voltage; Oxides; Polymers; Solar cells; Styrene; Temperature; Thiophene; Titanium; Titanium dioxide

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