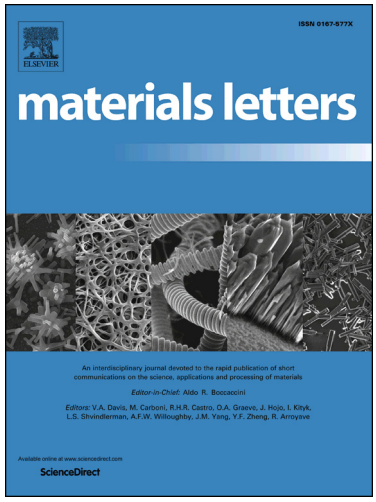

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Investigation of Conventional ITO/MoO_3/P3HT:$PC_{61}BM$/Ca/Al bulk heterojunction polymer solar cells through impedance spectroscopy in view of power conversion efficiency improvements

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Abstract

Herein, a bulk heterojunction (BHJ) organic solar cell of configuration ITO/MoO_3 (~10 nm)/P3HT: $PC_{61}BM$ (~ 100 nm) /Ca (~20 nm)/Al (~100 nm) having power conversion efficiency (PCE) ~1.89, fill factor of ~ 55, J_{sc} ~ 5.53 mA/cm^2 and V_{oc} ~ 0.62 V is characterized through impedance spectroscopy in dark as well as in illuminated conditions with varied bias voltages between 0.0 V to ± 0.7 V. The impedance data shows a depressed semicircle which may be modeled as usual by an equivalent circuit consisting of resistors, capacitors and a constant phase element. The model may be based on the geometrical capacitance, chemical capacitance as well as on the recombination resistance related to charge carrier accumulation/bimolecular recombination in the active layer. A typical impedance data, both in the form of cole-cole or in Bode mode is represented in view to understand its dependence on device of desired structure. There is a correlation between the frequency at which reactance reaches a peak value and a particular device structure and, consequently, the solar cell efficiency.

Keywords: Impedance Spectroscopy, Organic Solar Cells, Blonde Mode, Cole-Cole, BHJ, Power Conversion Efficiency (PCE)

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