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Charge injection at metal–polymer interfaces

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Abstract content
   (Max 300 words)

Interfacial phenomena across metal-polymer systems and are not yet well understood. The comprehension of the fundamental physics underlying opto-electronic and thermal excitations at metal-polymer interfaces is essential for the improvement of the conversion efficiency of a photovoltaic device, in particular, the organic solar cell. In this paper, the current limiting mechanisms around the metal/polymer interfaces, ITO/PEDOT:PSS-P3HT and Al-PCBM, are investigated and discussed. Experimental results for various voltage regimes are analysed and interpreted to gain insight into the elementary response to energy barrier (for example, the Schottky barrier height) fluctuations at the metal/polymer interfaces under external biasing in the dark. It is deduced that carrier injection and space charge formation are strongly affected by the metal-polymer interfaces in that, for small interface barrier height, <0.5 eV, current is space charge limited and for large barriers, current becomes injection constrained. Differing injection mechanisms are suggested. Wherein the Richardson-Schottky thermionic emission mechanism is found to dominate low voltage regime for hole injection at the ITO/PEDOT:PSS-P3HT interface into HOMO of P3HT through ITO/PEDOT:PSS, the Fowler – Nordheim quantum mechanical tunneling takes centre stage at higher voltages under reverse bias for hole injection at the Al-PCBM interface into HOMO of PCBM through Al.

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