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Type: Oral Presentation

Non-linear Fowler-Nordheim plots in thin film polymer-fullerene composite devices: Transition from electron-only to hole-only conduction

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We studied charge injection and transport mechanisms in blends of poly(3-hexylthiophene) (P3HT) and [6,6]-phenyl C₆₁-butyric acid methylester (PCBM), by analysing dark, temperature dependent current-voltage characteristics of the P3HT:PCBM blend thin films sandwiched between aluminium electrodes in a MIM configuration. We present a general method of interpreting Fowler - Nordheim plots of metal/semiconductor/metal devices with pronounced non-linear characteristics by dividing them into several regions based on physical origins. We show that by applying appropriate electric fields it is possible to switch from electron-only conduction to hole-only conduction in a single Al/P3HT:PCBM/Al device. We affirm that electrons can be selectively transported through the lowest unoccupied molecular orbital of PCBM at low applied voltages and low temperatures; and alternatively holes can be transported through the highest occupied molecular orbital of P3HT at higher applied voltages and high temperature, within a single device.

Level (Hons, MSc, PhD, other)?

PhD

Consider for a student award (Yes / No)?

No

Would you like to submit a short paper for the Conference Proceedings (Yes / No)?

Yes

Primary author: Dr CHIGUVARE, Zivayi (University of the Witwatersrand)

Presenter: Dr CHIGUVARE, Zivayi (University of the Witwatersrand)

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