

Study of Electrical Properties of An-Fl Based Organic Semiconducting Thin Film

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Abstract : In order to exploit the good electrical properties of anthracene and the excellent properties of fluorescein, new hybrid material has been synthesized (An-Fl). Current-voltage measurements were done on a new single-layer ITO/An-Fl/Al device of typically 100 nm thickness. Atypical diode behavior is observed with a turn-on voltage of 4.4 V, a dynamic resistance of 74.07 K Ω and a rectification ratio of 2.02 due to unbalanced transport. Results show also that the current-voltage characteristics present three different regimes of the power-law ($J \sim V^m$) for which the conduction mechanism is well described with space-charge-limited current conduction mechanism (SCLC) with a charge carrier mobility of $2.38 \cdot 10^{-5} \text{cm}^2 \text{V}^{-1} \text{S}^{-1}$. Moreover, the electrical transport properties of this device have been carried out using a dependent frequency study in the range (50 Hz-1.4 MHz) for different applied biases (from 0 to 6 V). At lower frequency, the σ_{dc} values increase with bias voltage rising, supporting that the mobile ion can hop successfully to its nearest vacant site. From σ_{ac} and impedance measurements, the equivalent electrical circuit is evidenced, where the conductivity process is coherent with an exponential trap distribution caused by structural defects and/or chemical impurities.

Keywords : semiconducting polymer, conductivity, SCLC, impedance spectroscopy

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