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Organic Semiconductor: Graphene-Oxide/p-Si Photodiodes

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Abstract

The device parameters of Al/p-Si/PCBM:GO/Au diodes were investigated using direct current voltage (I-V), photocurrent and impedance spectroscopy. The ideality factor of the diode was found to depend significantly on GO content. The calculated barrier heights had low variance over the range of illumination intensities per doping level. Under dark conditions the barrier height averaged 0.767 with a variance of less than 40 parts per million and the ideality factors averaged 10.2 +/- 0.4, both parameters taken across all the varying GO contents. The high ideality factors (>9) of the heterostructure organic/inorganic diodes are explained in terms of the low carrier mobilities of the organic interlayer. Capacitance voltage measurements indicate that the capacitance decreases with increasing frequency, suggesting a continuous distribution of interface states over the surveyed 100 kHz to 1.0 MHz frequency range. The photocurrent results indicate that the photocurrent increases with illumination intensity. The Al/p-Si/PCBM:GO/Au diode exhibits a similar photosensitivity with an illumination coefficient of approximately 1.23 +/- 0.001 over a wider range of PCBM:GO weight ratios and reverse bias. This suggests that the device photoconductivity is reasonably predictable and particularly suited for photoconductive sensing.

Keywords

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