

Nanocomposites and nanomaterials

Effective Medium approximation model of electrical conductivity in chemically-derived graphene nanoflake films

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Current-voltage (IV) characteristics have been studied in films of chemically-derived graphene (CDG) nano-flakes in lateral-diode geometry over temperature range from 300 to 5K. The CDG nano-flakes featured high polydispersivity with sizes varying from 20 to 300 nm as revealed by transmission electron microscopy. We found a positive temperature-dependent electrical conductivity over the whole temperature range and pronounced non-linearity in IV-characteristics at $T < 80\text{K}$. The experimental data cannot be fitted using the Schottky-diode effect model or conventional thermally-activated behavior. In this work, we demonstrate that the obtained puzzling results can successfully be described within an Effective Medium approximation model [1] we recently suggested for band-transport heterogeneous materials with spatial energy variation of the transport-band edge.

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1. *Fishchuk I.I., Kadashchuk A., Bhoolokam A., de Jamblinne de Meux A., Pourtois G., Gavriluk M.M., Köhler A., Bässler H., Heremans P., Genoe J., The interplay between hopping and band transport in high-mobility disordered semiconductors at large carrier concentrations // Phys Rev B. -2016. -**93**, -P. 195204-1-195204-14.*