ELECTRONIC TRANSPORT IN MULTIWALLED CARBON NANOTUBES

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In this work [1], low temperature transport in multiwalled carbon nanotubes (MWNT) has been studied at different diameters and lengths, within 2 - 10 nm, and 0.3 - 3.5 μm, respectively. In a majority of the samples, semiconductivity showed up as a transport gap in the gate voltage controlled conduction, but metallic MWNTs are found in all diameters. The transport gap is seen to be quantitatively determined by a diameter dependent bandgap, and length dependent localization of charge carriers. The bandgap of semiconducting MWNTs is estimated to be smaller than that extrapolated from the conventional expression applicable to semiconducting single wall carbon nanotubes. Our results constitute the first systematical study on size dependent transport and especially of semiconductivity in MWNTs. These results have significant similarities to the current research on graphene nanoribbons (GRN). As graphene does not intrinsically possess a bandgap, GNRs are fabricated, where a gap is created via quantum confinement due to the narrow width of the channel/nanoribbon. The size of the gap is then roughly in a similar inverse relation with the width, as in the case of the diameter dependence of the MWNT's in our work. relate to the hysteresis effect.

[1] D. Mtsuko, A. Koshio, M. Yudasaka, S. Iijima, and M. Ahlskog, Physical Review B. **91**, 195426 (2015)