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Edge disorder in armchair-edge graphene nanostrips[1] DENIS A. ARESHKIN, George Washington University, DANIEL GUNLYCKE, CARTER T. WHITE, Naval Research Laboratory — Graphene nanostrips created using current lithography techniques will likely contain edge irregularities due to lack of atomic precision. We present tight-binding calculations which show that these edge irregularities have a strong effect on electron transport in armchair-edge graphene nanostrips. The edge disorder causes Anderson localization which effectively suppress the electronic conductance in samples which are longer than the mean-free path. We estimate the mean-free path via the localization length which is calculated by averaging over a large number of disordered nanostrips. We find that the localization length approximately decreases with the square of the width of the nanostrip and is of the order of tens of nanometers at the width 20 nm. The localization length also depends on the concentration of edge defects and energy. Only nanostrips with low concentration of edge disorder reflect expected semiconducting gaps in the localization length. We also find that the Anderson localization extends over the entire π-electron energy range. With this result in mind, we predict that long and narrow armchair-edge graphene nanostrips are insulators.

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