Ballistic transport at room temperature in micrometer size multigraphene

S. Dusari+, J. Barzola-Quiquia+, P. Esquinazi+, N.Garcia*

+Division of Superconductivity and Magnetism, Universität Leipzig,
Faculty of Physics and Earth Sciences, Institute for Experimental Physics II,
Linnéstr. 5, 04103 Leipzig, Germany
*Laboratorio de Física de Sistemas Pequeños y Nanotecnología, Consejo Superior de Investigaciones Científicas, Serrano 144, E-28006 Madrid, Spain
Contact: srujana@physik.uni-leipzig.de

As an emergent material for electronic applications, graphite and graphene and their electrical transport properties have become a subject of intense focus. The intrinsic values of the carrier mobility and density of the graphene layers inside graphite, the well known structure built on these layers in the Bernal stacking configuration, are not well known mainly because most of the research was done in rather bulk samples where lattice defects hide their intrinsic values. By performing transport measurements through micro and submicro constrictions in ~10 nm thick graphite samples, we observe drastic increase in the resistance decreasing the constriction width. Our experimental observations indicate that electrons behave ballistically even at room temperature and with mean free path of the order of microns. The values obtained for the mobility ($\mu \sim 10^{7} cm^{2} V^{-1} s^{-1}$) and density of the electrons ($n \sim 10^{8}$ cm^{-2}) indicates that the graphene layers inside graphite are of higher quality than single ones. The decrease of magneto resistance with decreasing constriction width also indicates that the carrier mean free path is larger than few microns at room temperature. These distinctive transport and ballistic properties have important implications for understanding the values obtained in single graphene and in graphite as well as for implementing in nanoelectronic devices.