Magnetotransport in Graphene

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Abstract

Graphene is a flat single layer of carbon atoms tightly packed into a two-dimensional (2D) honeycomb lattice, and is a basic building block for graphite material. It can be wrapped up into 0D fullerenes, rolled into 1D nanotubes or stacked into 3D graphite.

The band structure of monolayer graphene is unusual, where it is a zero-gap semiconductor with a linear energy dispersion relation and the charges behave as massless Dirac fermions. Charge transport in graphene exhibits a number of novel phenomena, such as the half-integer quantum Hall effect. Technologically, graphene attracts a special attention as a promising post-silicon electronic material due to its exceptional mobility, current-carrying capacity, and thermal conductivity.

In this work the graphene samples were produced by the use of the mechanical exfoliation method. Si wafer was used as a substrate with a precise 300nm oxide layer on top. The initial identification of the graphene was performed using the optical microscope by means of the interference contrast. The thickness (number of layers) was determined by the use of the Atomic force microscopy and the Raman spectroscopy. Electron beam lithography was used to make metallization contact the graphene with special electrodes. Standard hall measurements were performed with a perpendicular magnetic field. The resistance (Rxx and Ryx) was measured as a function of the magnetic field with temperature as a parameter. Shubnikov de Haas Oscillation dependence on temperature was studied. Different parameters such as effective mass and carrier density were determined. Weak localization was studied for some samples.