Transport properties of multi-graphene films grown on semi-insulating SiC

Lebedev S.P.*[1], Strel'chuk A.M.[1], Shamshur D.V.[1], Agrinskaya N.V.[1], Lebedev A.A.[1]

[1]*Ioffe Physical-Technical Institute RAS, St.-Petersburg 194021, Russia*
**e-mail: lebedev.sergey@mail.ioffe.ru*

High-quality monolayer graphene has been obtained in small tens of microns areas by exfoliation of highly ordered pyrolytic graphite. However, this exfoliation process cannot form the basis for a large scale manufacturing process. To become a viable technology, wafer-scale graphene muSt be grown on a substrate while preserving the electronic properties of an isolated graphene sheet. A potential platform is epitaxial graphene on SiC(0001).

For our investigations we used multi-graphene films grown on semi-insulating 6H-SiC on-axis wafers with polished $C(000\bar{1})$-face. Graphene was formed by sublimation of Si from wafer surface. The wafers were annealed in a high-vacuum chamber (residual pressure of $\sim 10^{-6}$ Torr) in the temperature range of 1400-1500°C. Quality of multi-graphene films was examined by Atomic force microscopy (AFM) and Raman spectroscopy.

On the beSt samples Hall-Bar structures with 6 ohmic contacts for transport properties investigation was formed. The electro-physical measurements were done on graphene area with small sizes. To get small size graphene area (10×120 mkm) photolithography and argon beam etching was used.

Volt-ampere and Hall-effect measurements were done in the temperature range of 1.4-300K. It was founded, that at $T \leq 40$ samples conductivity decrease with decreasing temperature varies logarithmically, which is typical for two dimensional metals (regime of weak localization). Hall-effect measured by 4.2K and 1.4K gave the carrier concentration $n \approx 5 \times 10^{12} cm^{-2}$.

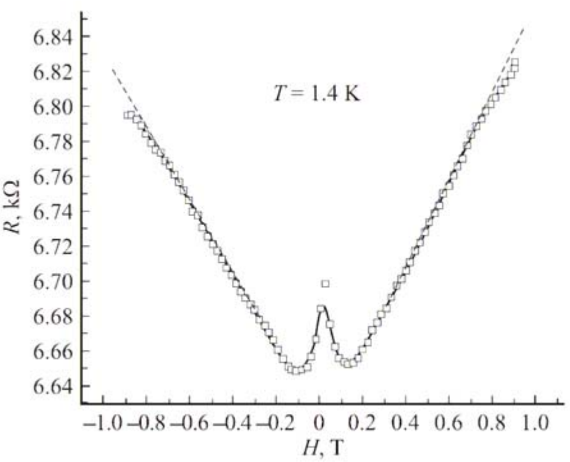

Figure. 1 Magnetoresistance of multi-graphene film on SiC (Temperature – 1.4K)

On the Figure 1 low temperature measurement of multi-graphene film magnetoresistance is shown. At low magnetic fields negative magnetoresistance appears which is also connected with weak localization.

Thus, low temperature features of charge carriers transport properties confirm presents of two dimensional holes gas in investigated samples.

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