Magnetotransport properties of epitaxial graphene grown on SiC

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We performed magnetotransport studies of the graphene layers grown on semi-insulating SiC by CVD method [1]. Two kinds of samples were studied: samples grown on (000-1) SiC and on (0001) SiC. The samples were processed by means of optical lithography into large hall bars (263μm x 526μm) with Ti/Au metallization for ohmic contacts. Resistivity tensor was measured in Oxford Instruments VTI system in temperatures ranging from room temperature down to 1.5 K and magnetic fields up to 12T, with additional illumination of the samples at low temperatures.

We have observed significant differences in the electrical properties for the two polarities. The samples grown on the silicon (0001) polarity showed quantum oscillations of the resistivity tensor. They had electron conductivity with Hall mobility of the order of 1000 $cm^2/V{\cdot}s$ and Hall concentration of about $3{\cdot}10^{12}$ cm^{-2}. The samples prepared on carbon–terminated SiC were n-type but with significant contribution of holes evidenced by mobility spectrum analysis [2] with large effective Hall concentration of $3{\cdot}10^{13}$ cm^{-2} and Hall mobility a few times lower than in silicon-polarity samples. No oscillations were registered for that group of samples. We have observed that the samples grown on Si-terminated SiC were very sensitive to external environment (making FLG a potentially sensing material), to thermal cycles and exposure to light. In particular, they showed changes of the order of a few % after each 4 K – room temperature thermal cycle while those grown on C-terminated SiC were stable (samples were kept under He atmosphere at all times). Looking for the possible explanation we performed subsequent experiments with illumination of the samples at low temperatures. The behaviour of the samples grown on Si-polarity SiC was influenced by light whereas the other samples showed no such sensitivity. This diverse sensitivity of FLG to thermal cycles and light is discussed in this report.

References:
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