High field magneto-transport in Graphene Grown by Chemical Vapor Deposition on SiC

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We investigate on the transport properties of graphene on silicon carbide (SiC)[1] in the quantum Hall regime. The longitudinal and Hall resistances have been measured of up to 67T in a temperature range between 1.6K and 120K. For low carrier densities, we observe a broad plateau of the Hall resistance at $R_{xy}=h/2e^2$, spanning from B=7T to B=67T (and up to 80T in a separate experiment). In the usual QHE model, the width of the quantized Hall plateaus depends on the ratio between localized and extended states. However, the very broad magnetic field range over which the Hall resistance plateau at filling factor ν=2 is established cannot be explained within this usual picture. Following the lines of reference[2-4], a charge transfer between the SiC donor states and graphene could be a possible route to explain the very large width of the last Rxy plateau. Nevertheless, this model neglects the effects of the internal Landau level structure due to disorder and predicts a fixed charge carrier density above a moderate magnetic field. Such a prediction is not consistent with our new experimental observations at very high magnetic field. On the contrary, we believe that both the effect of charge transfer and the nature of the disorder must be considered in order to explain the peculiar QHE in graphene on SiC. At very high magnetic field, the temperature evolution of the longitudinal resistance is analyzed within the framework of Variable Range Hopping describing the onset of a localization-delocalization transition. The extracted critical exponent is in agreement with a quantum percolation plateau-plateau transition when the Fermi energy approaches extended sates. This observation points towards a possible spin and valley degeneracy lifting of the N=0 Landau level at high magnetic field. Unexpectedly, we also observe faint but reproducible Shubnikov-de Haas oscillations of the longitudinal resistance for B>20T. Although the origin of these oscillations is still unclear at the moment, we believe they originate from non-homogeneous doping of the sample during device fabrication.

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