Supplementary Information

In order to measure the thickness of the deposited graphene layers, a cross-correlation study between optical microscope and AFM images was made. As shown in Fig. S1 (a), there are color contrast changes in the samples with different thicknesses due to interference induced color shifts. These color shifts are sensitive to the number of graphene layers on top of the SiO_2/Si substrate. We also note that the thickness of SiO_2 layer affects the contrast between different layers. 300 nm thick thermally grown SiO_2 layer yields the best contrast for this purpose as was described in ref. [s1]. Once the optical images are taken, the sample profiles are probed using various AFMs (MultiMode, Digital Instrument and XE100, PSIA). Fig. S1 (b) shows an AFM image of the samples in the boxed region in Fig S1(a). The detailed AFM height profile analysis (inset) shows that the apparent height of region (I) and (II) are 0.8 nm and 1.2 nm, respectively. A step of one atomic layer height (~0.4 nm) is observed between regions (I) and (II), indicating the region (II) has an additional layer of graphene. Since a single sheet of graphene is 0.35 nm thick, the region (I) is comprised of at most two graphene layers. However, considering an additional van der Waals (vdW) distance between graphene and the SiO_2 surface (~ 0.3 nm)[s1], we speculate that the region (I) is most likely a single layer, unless the AFM tip to graphene interaction is much stronger than that of the AFM tip to SiO_2 interaction. This is highly unlikely, since AFM profile analysis has been successfully used for determining diameter of carbon nanotubes, a material that share much similarity with graphene, where diameters are confirmed by well established cross-correlation between AFM and Raman spectroscopy.[s2]

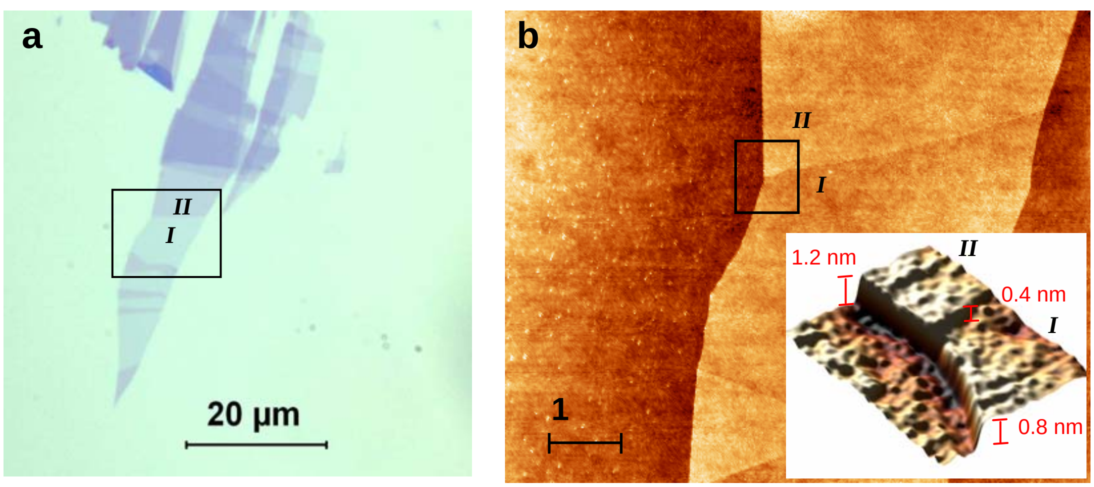

Figure S1 Cross-correlation of optical microscope and AFM images of few layer graphite samples. **a,** An optical microscope image of micro-cleaved graphite samples deposited on a SiO2/Si substrate. **b,** An AFM image of potentially single and double layer graphene samples observed in the boxed region of **a**. The inset shows a detailed AFM height profile in the boxed region of the main panel.

In addition to the AFM profile analysis discussed above, there is evidence that the region (I) and (II) in Figure S1 corresponds to a single and double layer graphene, respectively.

We measured magnetoresistance and Hall resistance of the samples that have the same color shift corresponding to region (II). Unlike the device made from material from region (I) (the samples reported in the main text), the 'double' layer samples exhibit a 'conventional' QHE, where the quantization condition is described by $\nu = g_s n$ with integer n rather than half integer values as in the case of single layer graphene (Fig. S2). This result supports that the samples corresponding to the color shift in region (I) is indeed special and represents a single layer of graphene.

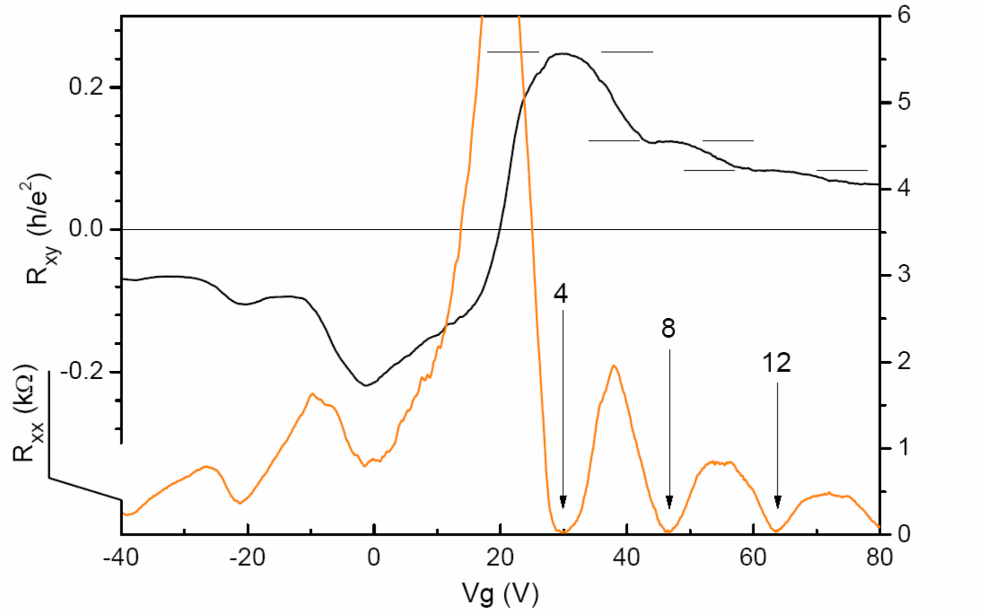

Figure S2 Quantized magnetoresistance and Hall resistance of a double-layer graphene samples as a function of gate voltage. Hall resistance (black) and magnetoresistance (red) are measured at T = 1.7K and B = 14 T. While the hole carriers (V_g< 20 V) do not exhibit the QHE, the electron carriers (V_g > 20 V) do exhibit the 'conventional' QHE. The filling factor ν is described by an integer: $\nu = g_s$ n, where n =1, 2, 3, ..., unlike the half-integer QHE observed in single layer graphene. The vertical arrows and numbers on them indicate the values of *B* and the corresponding filling factor ν. The horizontal lines correspond to $h/e^2\nu$ values.

References

S1. Novoselov, K. S. *et al*. Electric field effect in atomically thin carbon films. *Science* **306**, online-supporting materials (2004).

S2. Zheng, L. X. *et al*. Ultralong single-wall carbon nanotubes, *Nature Materials* **3**, 673-676 (2004).