

Supplementary information

Part 1 Light illumination correction

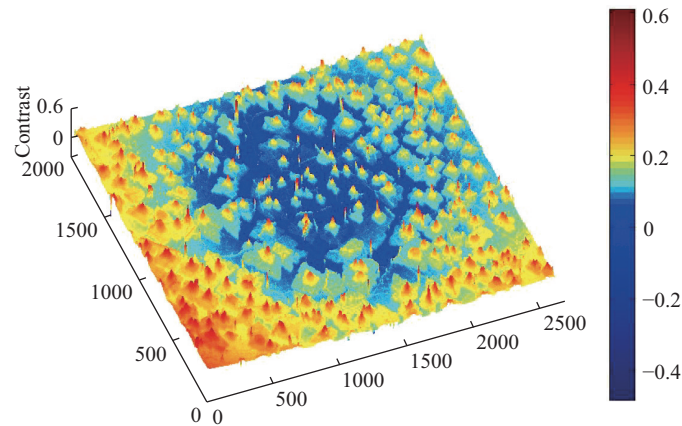


Fig. S1. (Color online) 3D G-channel optical contrast image of CVD graphene (shown in Fig. 2(a)) without light illumination correction. The thickness of multi-layer domains cannot be identified.

Part 2 Thickness identification of graphene layers by Raman spectroscopy

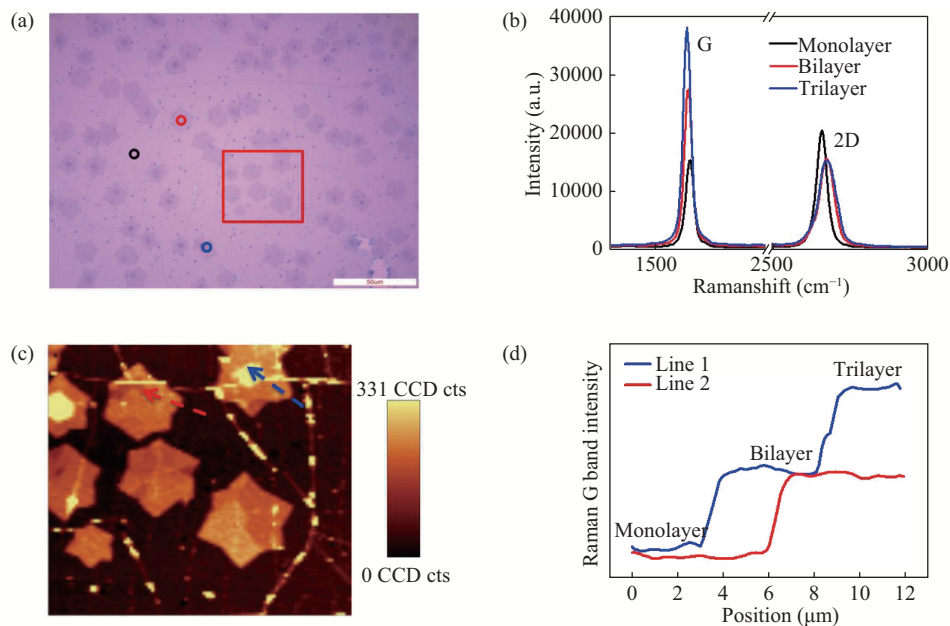


Fig. S2. (Color online) (a) Optical image of CVD graphene with multi-layer domains. (b) Raman spectra obtained from the marked spots corresponding to monolayer, bilayer and trilayer graphene, respectively. (c) Raman image of G peak intensity of the area marked by red box in (a), (scale, length $\sim 50 \mu\text{m}$, width $\sim 45 \mu\text{m}$, 500 nm step size). (d) The cross section of the G peak Raman image corresponding to colored dashed lines in (c).

Fig. S2(a) displays the optical image of CVD graphene sample, which covered by monolayer graphene and multilayer domains. As showed in Fig. S2(b), the Raman spectra measured at three marked positions in Fig. S2(a) demonstrates that this sample contains monolayer, bilayer and trilayer. Fig. S2(c) gives G peak intensity Raman mapping of the area surrounded by red solid line in Fig. S2(a). Monolayer, bilayer and trilayer can be distinguished obviously in the cross section corresponding to dashed lines in the Raman image, as shown in Fig. S2(d).

Part 3 Thickness identification of mechanical exfoliated graphene



Fig. S3. (Color online) (a) The optical image of mechanical exfoliated graphene. (b) The selected area of the sample (The marked area in (a)). (c) The distribution of G-channel contrast of the selected area.

Table S1. The fitting results and coverage ratio of each layer.

Name	Centre	FWHM	Height	Area	Ratio of coverage (%)
Substrate	0	0.011	0.0047	6.23×10^{-5}	11.38
Monolayer	0.080	0.013	0.0046	9.11×10^{-5}	16.70
Bilayer	0.143	0.011	0.0212	2.77×10^{-4}	50.83
Trilayer	0.198	0.012	0.0045	7.85×10^{-5}	14.50
Four-layer	0.241	0.012	0.0024	3.57×10^{-5}	6.61

The thickness identification by optical imaging performs even better for mechanical exfoliated graphene. Fig. S3(a) shows an optical image of mechanical exfoliated graphene. The area marked by red box in Fig. S3(a) was cropped by Matlab software, showed in Fig. S3(b). Fig. S3(c) shows the contrast distribution of the selected area. The five peaks corresponding to bare substrate, monolayer, bilayer, trilayer and four-layer respectively. The fitting results and coverage ratio of each layer are shown in Table S1.

Part 4 The optical images of samples used for transport measurements

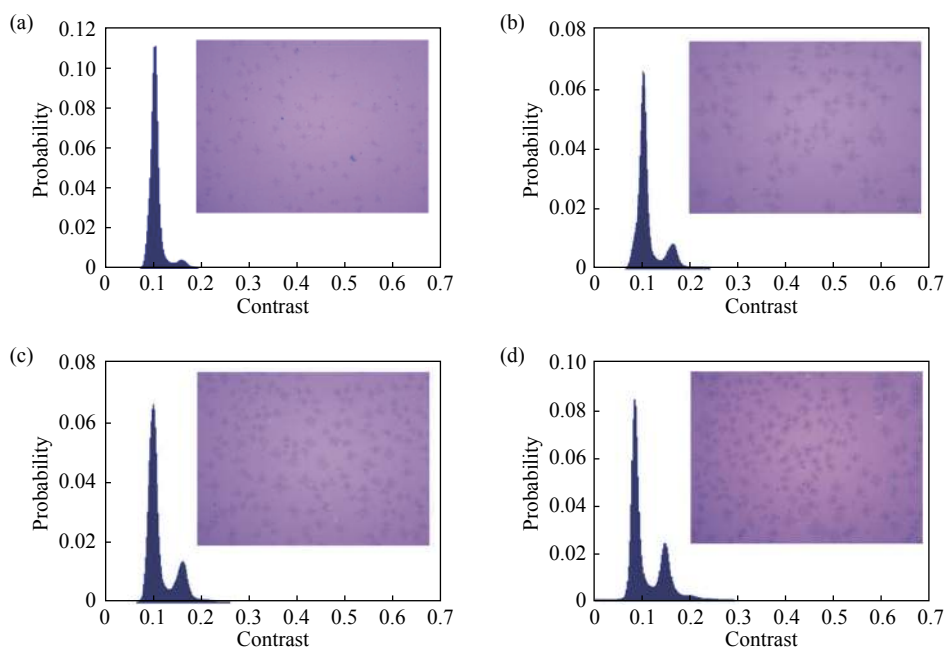


Fig. S4. (Color online) The optical images (inset) and their G-channel contrast distributions of the samples used for electrical measurement with bilayer coverage of (a) 1.62%, (b) 9.99%, (c) 25.05%, and (d) 31.53%.