Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

One-pot liquid-phase exfoliation from graphite to graphene with carbon quantum dots

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Supplementary Figures

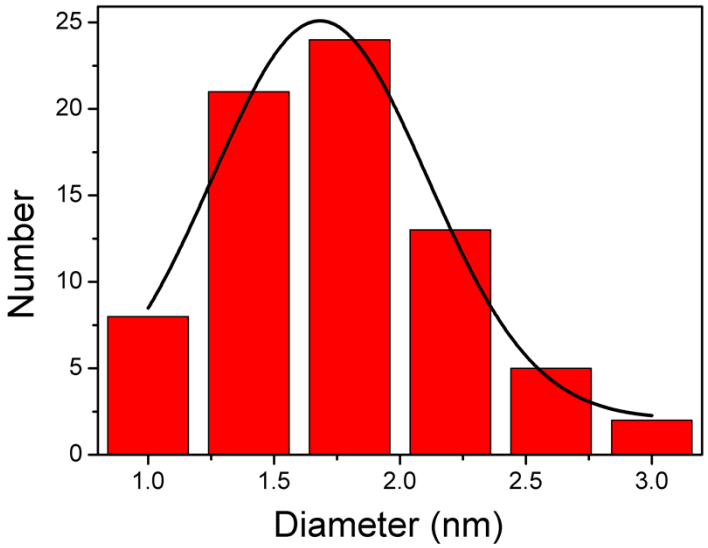

Fig. S1 Particle size distribution of CQDs.

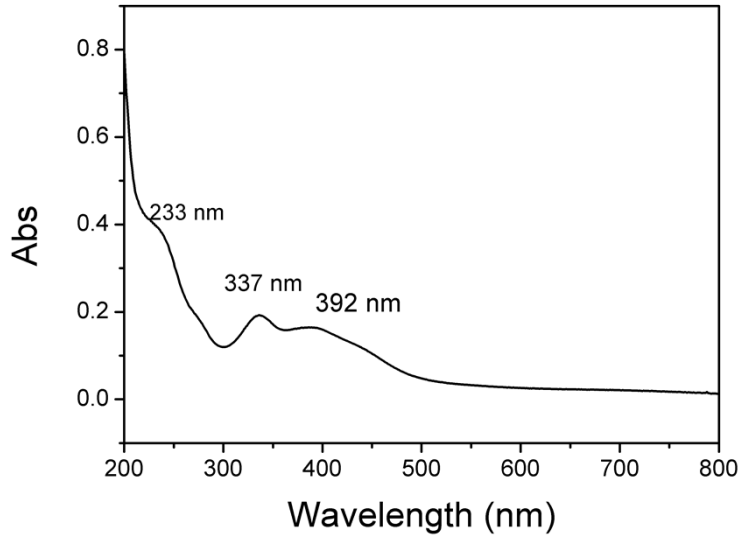

Fig. S2 UV-vis spectrum of CQDs.

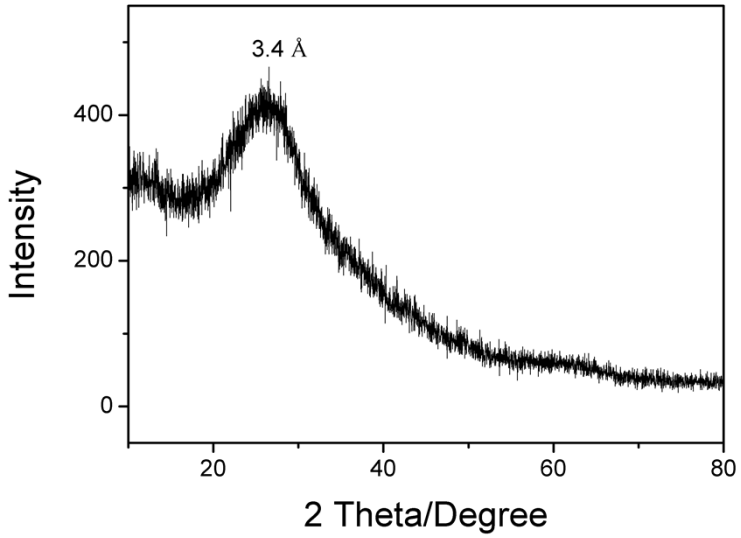

Fig. S3 XRD pattern of CQDs.

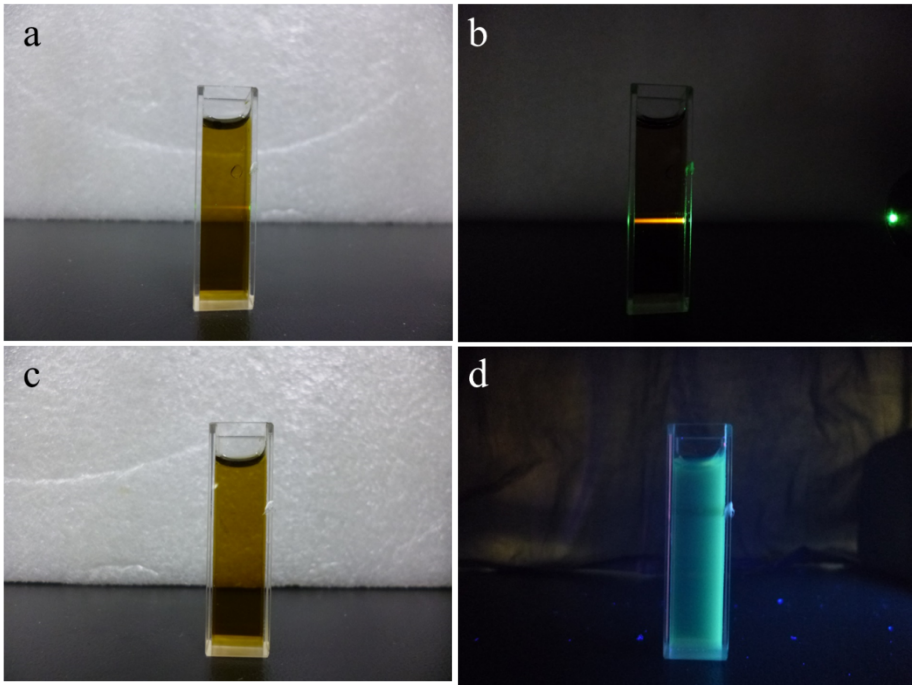

Fig. S4 CQDs solution (a) under visible light and (b) at dark with a green laser bean irradiation of 532 nm; CQDs solution (c) under visible light and (d) at dark under an ultraviolet beam of 365 nm.

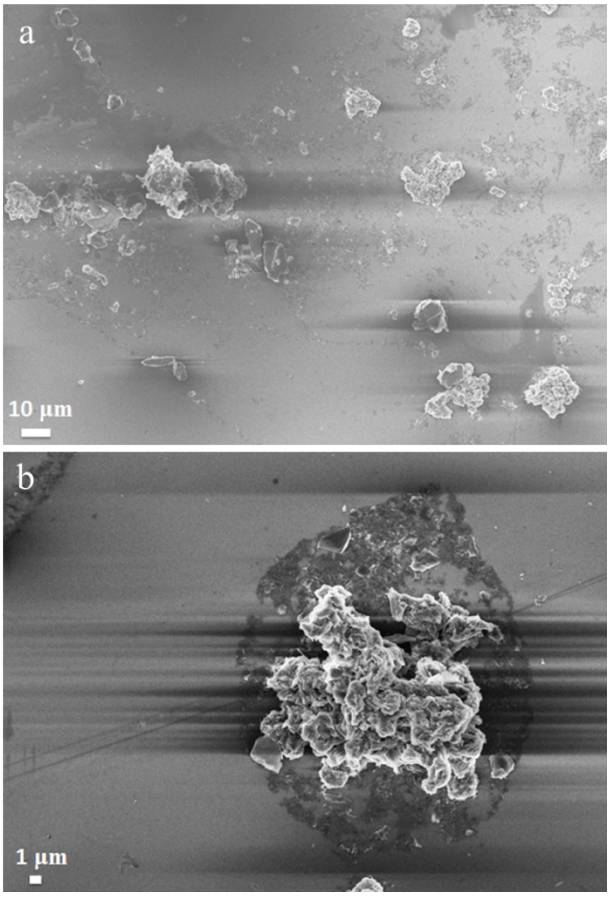

Fig. S5 SEM images (a) and (b) of control experiments with only graphite in aqueous medium under sonication condition.

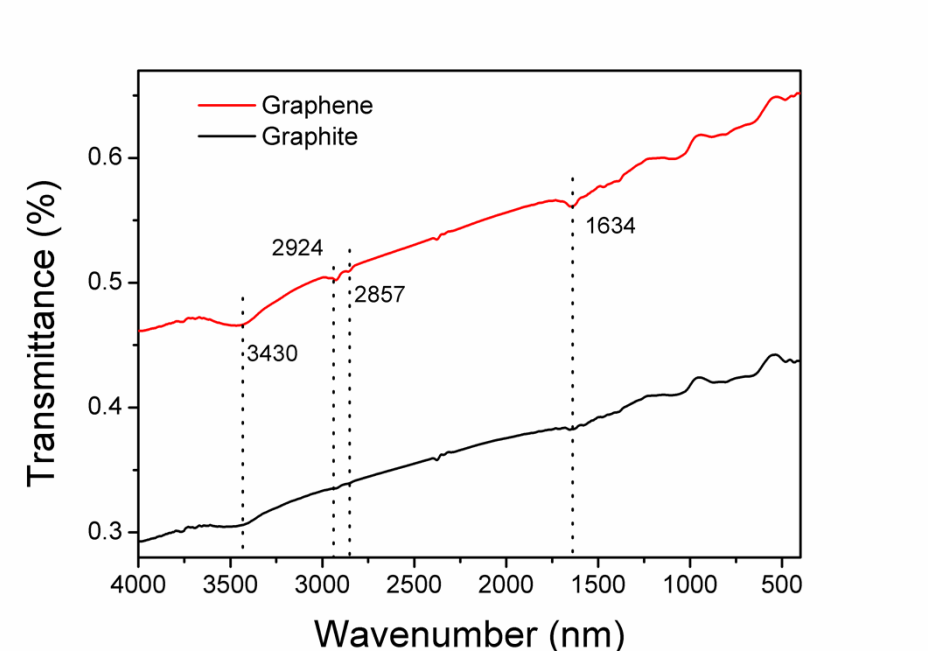

Fig. S6 FT-IR spectra of pristine graphite and exfoliated graphene.

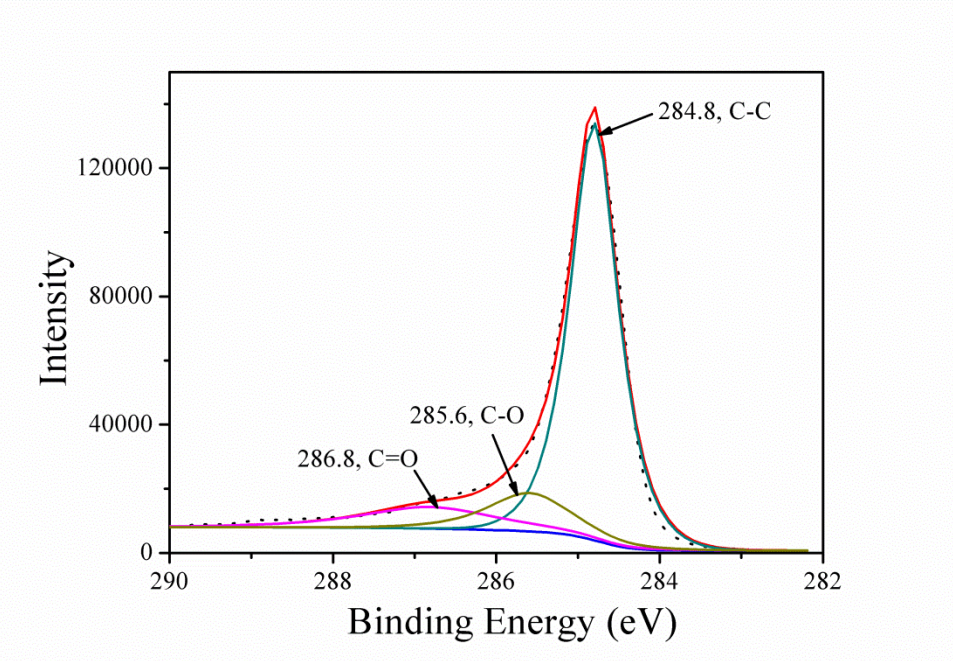

Fig. S7 C1s core level XPS spectrum of exfoliated graphene film.

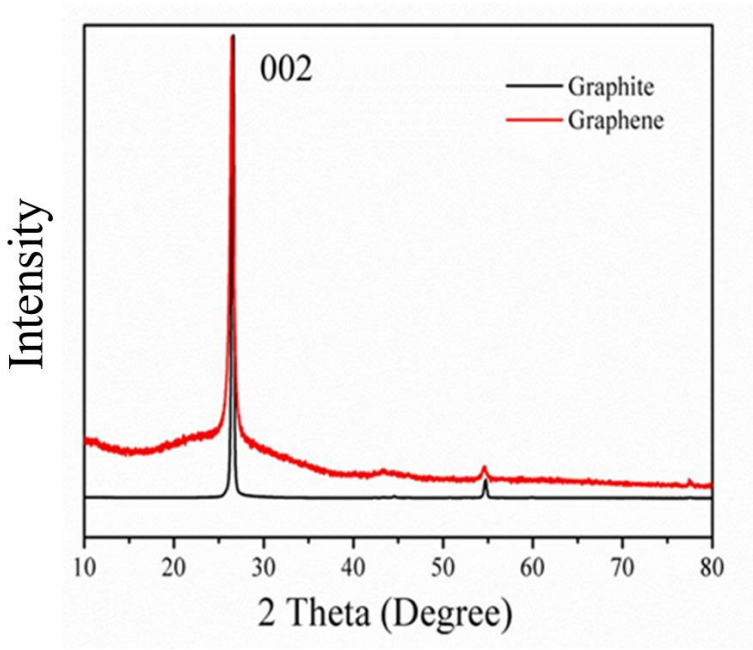

Fig. S8 Normalized XRD patterns of (a) pristine graphite and (b) exfoliated graphene.

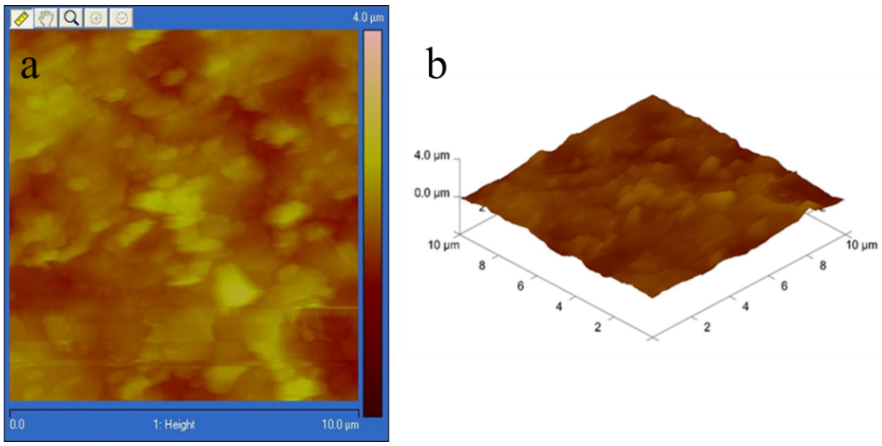

Fig. S9 AFM images of the graphene film (a) 2D topography image and (b) 3D topography image.

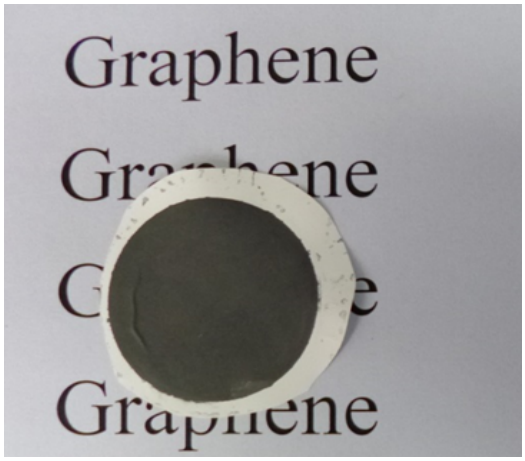

Fig. 10 The photo of the exfoliated graphene film.

Supplementary Tables

Table S1 The detailed supporting information of Fig. S9.

Parameter	Value
Image Raw Mean	-404 nm
Image Mean	-0.0208 nm
Image Z Range	1625 nm
Image Surface Area	147 μm^2
Image Projected Surface Area	100 μm^2
Image Surface Area Difference	46.5 %
Image Rq	246 nm
Image Ra	193 nm
Image Rmax	1598 nm

Table S2 Comparison of electrical properties of graphene-based materials fabricated by liquid-phase exfoliation.

Exfoliation methods	Sheet resistance (Ω/□)	Transmittance values	Ref.
Rose bengal	30270, 7800, 1600	87 %, 43 %, 20 % at 550 nm	2
Chlorosulphonic acid	1000	80 % at 550 nm	3
SDBS	22500	62 % at 632 nm, annealing@250 °C in Ar/N_2 for 2h	4
NMP	7100	61 % at 632 nm	5
Our method/CQDs	400 ~ 500	193 nm surface roughness	/

Note：SDBS: sodium dodecyl benzene sulfonate; NMP: N-Methylpyrolidone

Supplementary References

1 S. N. Qu, X. Y. Wang, Q. P. Lu, X. Y. Liu, and L. J. Wang, *Angew. Chem. Int. Ed.,* 2012, **51**, 12215.

2 G. S. Bang, H.-M. So, M. J. Lee, and C. W. Ahn, *J. Mater. Chem.,* 2012, **22**, 4806.

3 N. Behabtu, J. R. Lomeda, M. J. Green, A. L. Higginbotham, A. Sinitskii, D. V. Kosynkin, D. Tsentalovich, A. N. G. Parra-Vasquez, J. Schmidt, E. Kesselman, Y. Cohen, Y. Talmon, J. M. Tour, and M. Pasquali, *Nat. Nanotechnol.*, 2010, **5**, 406.

4 M. Lotya, Y. Hernandez, P. J. King, R. J. Smith, V. Nicolosi, L. S. Karlsson, F. M. Blighe, S. De, Z. M. Wang, I. T. McGovern, G. S. Duesberg, and J. N. Coleman, *J. Am. Chem. Soc.,* 2009, **131**, 3611.

5 Y. Hernandez, V. Nicolosi, M. Lotya, F. M. Blighe, Z. Sun, S. De, I. T. McGovern, B. Holland, M. Byrne, Y. K. Gun'Ko, J. J. Boand, P. Niraj, G. Duesberg, S. Krishnamurthy, R. Goodhue, J. Hutchison, V. Scardaci, A. C. Ferrari, and J. N. Coleman, *Nat. Nanotechnol,.* 2008, **3**, 563.