Electronic Supplementary Information

High Shear-Induced Exfoliation of Graphite into High Quality Graphene by Taylor-Couette Flow

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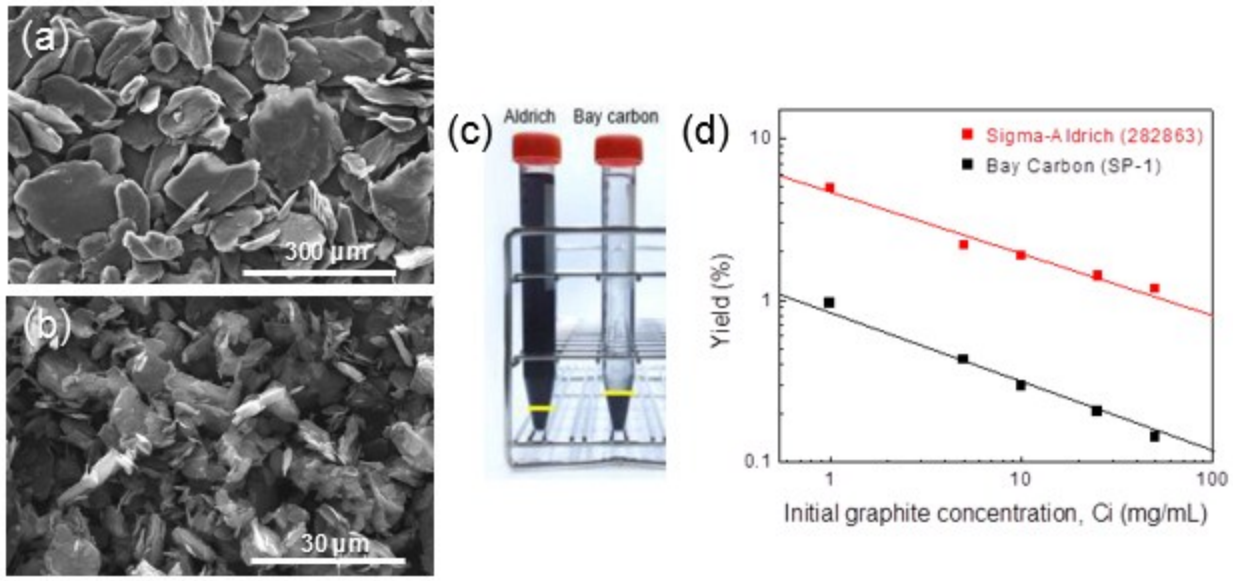
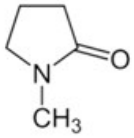
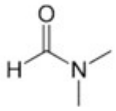
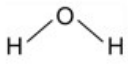
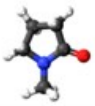
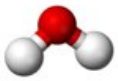


Figure S1. SEM images of graphite powders: (a) Bay Carbon SP-1 and (b) Sigma-Aldrich 282863. (c) graphene dispersions produced by shear-exfoliation of different graphite powders. Photograph was taken after centrifugation. (d) comparison of graphene production yield.

(a)

	NMP	DMF	H_2O
structure			
			
surface energy (mJ/m^2)	~ 70	67	103
boiling point (°C)	204	153	100

(b)

Figure S2. (a) Solvents used for shear exfoliation of graphite. (b) graphene dispersions produced by shear-exfoliation of graphite powders in different solvents. Photographs were taken after centrifugation.

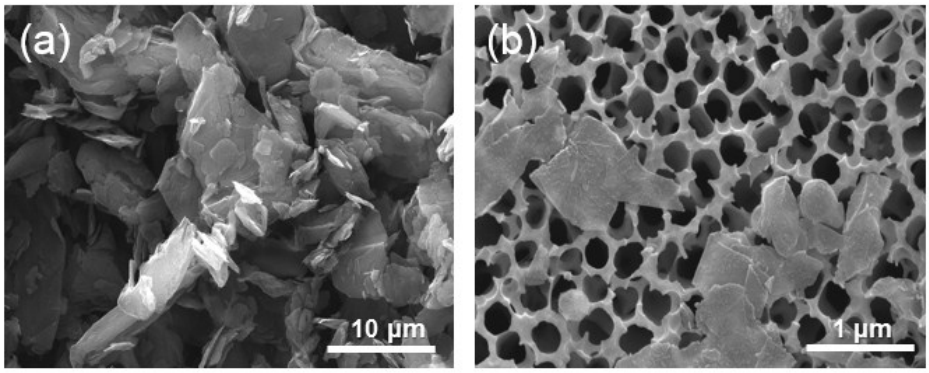


Figure S3. SEM images of (a) graphite powders (Sigma-Aldrich 282863) and (b) graphene sheets produced by shear exfoliation of graphite. Graphene were vacuum-filtered on a alumina membrane.

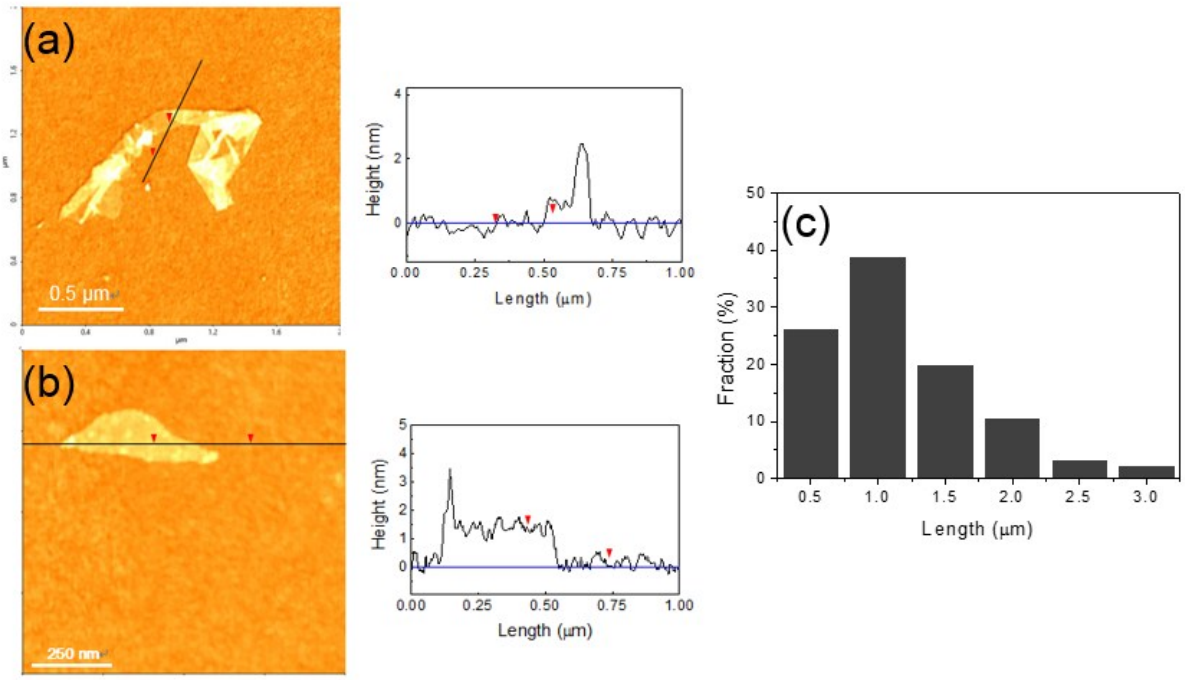


Figure S4. (a) and (b) AFM images of graphene sheets produced by shear-exfoliation of graphite and the corresponding AFM height profiles. (c) Length (the longest dimension) histogram for shear-exfoliated graphene.

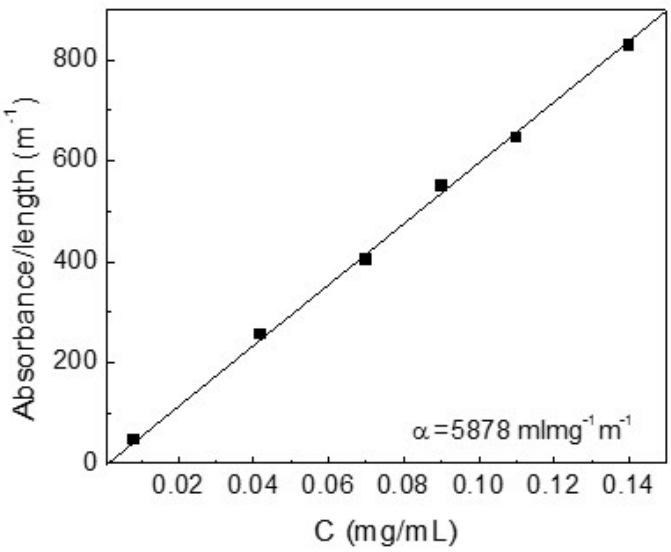


Figure S5. Measurement of absorption coefficient of graphene dispersion produced by high shear-induced exfoliation.

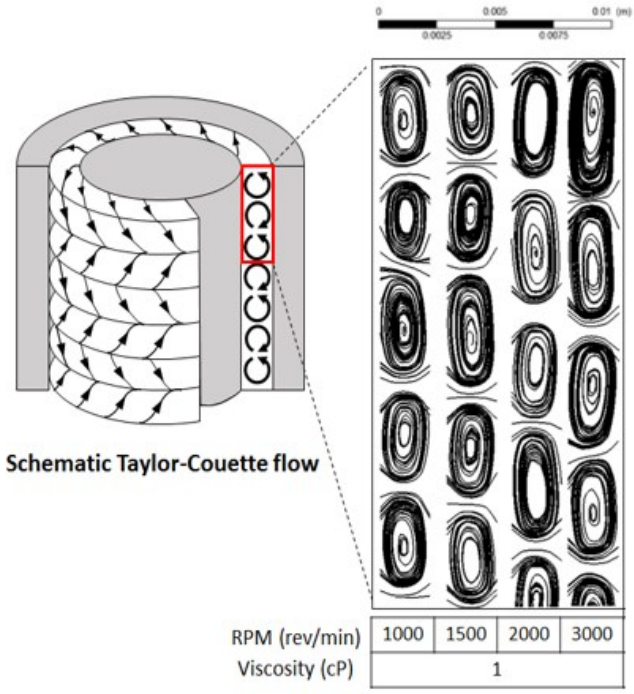


Figure S6. Streamline of a Taylor-Couette flow with respect to the rotation speed of inner cylinder.

Table S1. Comparison of graphene production methods.

Ref	Method	Raman I_D/I_G	Oxidation state	Yield	Remarks
This work	Shear exfoliation using a Taylor-Couette flow reactor	~0.14	None	~5%	Scalable, high yield, overall process duration < 1 h
1	Shear exfoliation using a L5M Silverson Mixer	0.17-0.37	None	<0.1%	Scalable, moderate yield
2	Sonication in NMP	~0.22	None	–	Overall process duration > 160 h, Low yield
3	Sonication in Water/SDBS surfactant	~0.4	~14%	<3.6%	Small scale *(25mL),* high oxidation state
4	Wet milling in the presence of SDS	0.6-0.7	None	-	High degree of defect.
5	Interlayer catalytic exfoliation with $FeCl_3$ and H_2O_2	0.1	None	-	Overall process duration ~26 h
6	Mild sonication in the presence of gum arabic	~0.25	-	~5%	Overall process duration > 100 h
7	High-shear mixing and sonication in ortho-dichlorobenzene	<0.3	10%	<5%	High oxidation state

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