Supplementary Information

Exfoliation and Performance Properties of Non-Oxidized Graphene in Water

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Section A. Structural Formulas of the Four Compounds Investigated in this Study

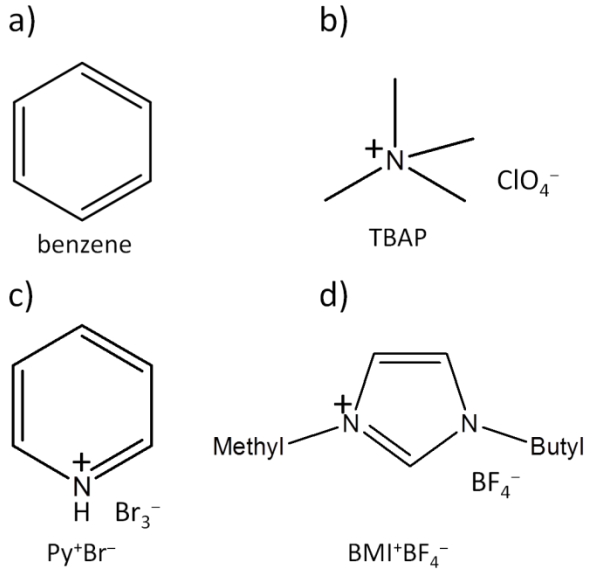

Figure S1 Structural formulas for: a) benzene, b) tetrabutylammonium perchlorate (TBAP), c) pyridinium tribromide ($Py^{+}Br_3^{-}$), and d) 1-butyl-3-methylimidazolium tetrafluoroborate ($BMI^{+}BF_4^{-}$).

Section B. Diffraction pattern of sample C

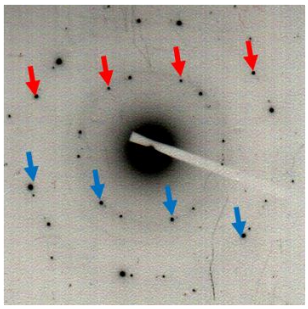

Figure S2 Selected area diffraction pattern of sample C with two sets of hexagonal patterns which are relatively rotated. Red arrows indicate single-layered graphene. Blue arrows indicate bi-layered graphene.

Section C. Tapping mode AFM image of exfoliated graphene sheets

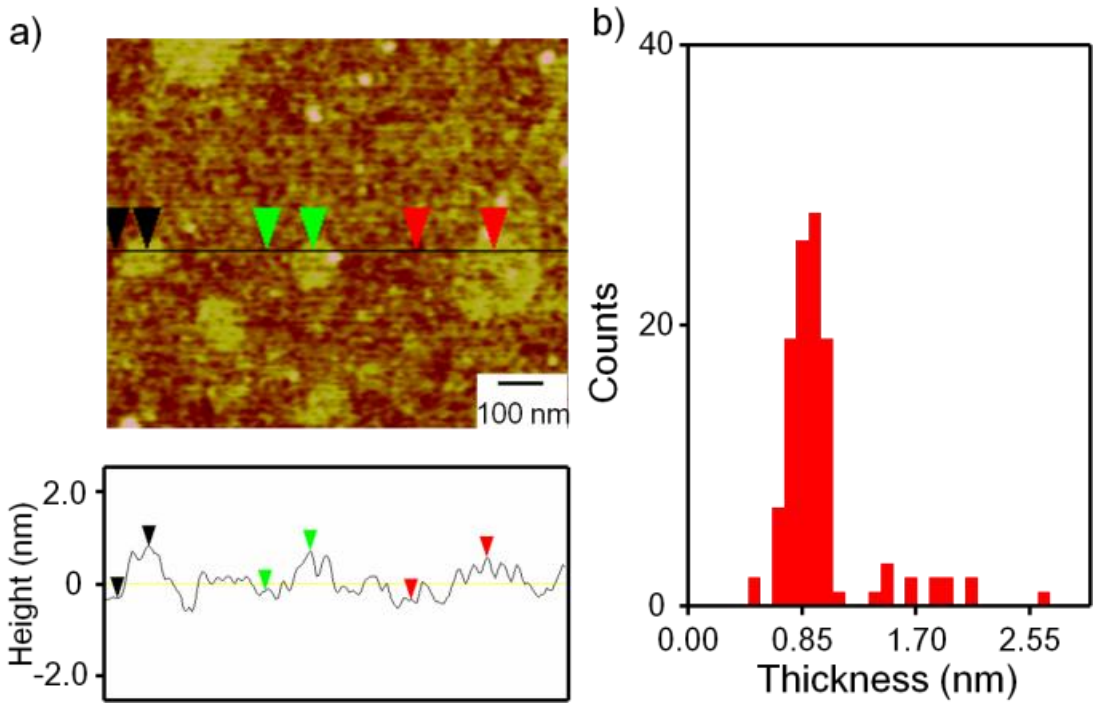

Figure S3 Tapping mode AFM images (1 μm × 1 μm) of exfoliated graphene sheets deposited onto a Si wafer substrate from a $Py^{+}Br_3^{-}$ dispersion.

Section D. The average EGS flakes size

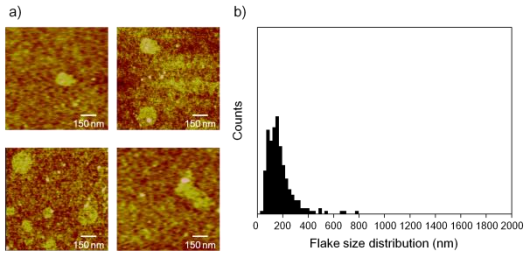

Figure S4 The average graphene size and its distribution. a) AFM images of the EGS. b) The size distribution histogram constructed from 239 EGSs.

Section E. Dynamic Light Scattering (DLS) measurements

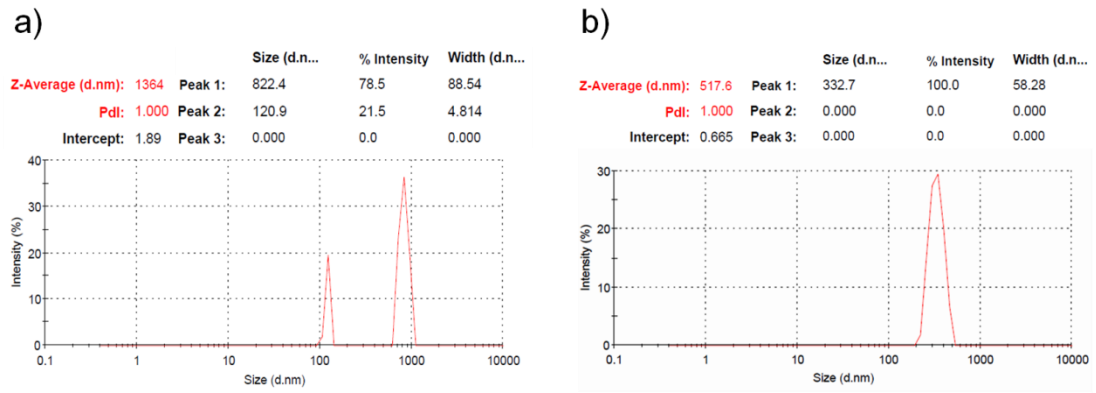

Figure S5 Hydrodynamic size of the exfoliated graphene sheets measured using dynamic light scattering. a) Sample C, and b) Sample D.

Section F. XPS spectrum of graphene sheets exfoliated in water with Py^+

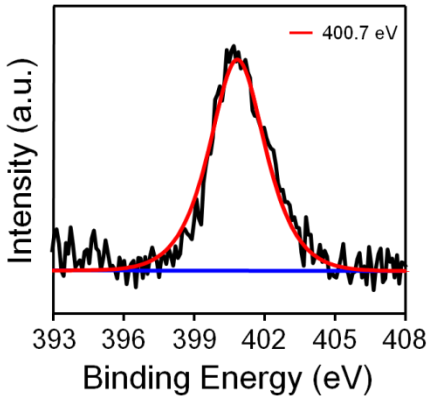

Figure S6 High-resolution core-level N 1s XPS spectrum of graphene sheets exfoliated in water with Py^+. The measurement was conducted at 10^{-8} torr. XPS samples were prepared by dropping the sample on a Si wafer followed by drying of the solvent under ambient conditions at room temperature.

Section G. FTIR-ATR spectra of HOPG and the EGS

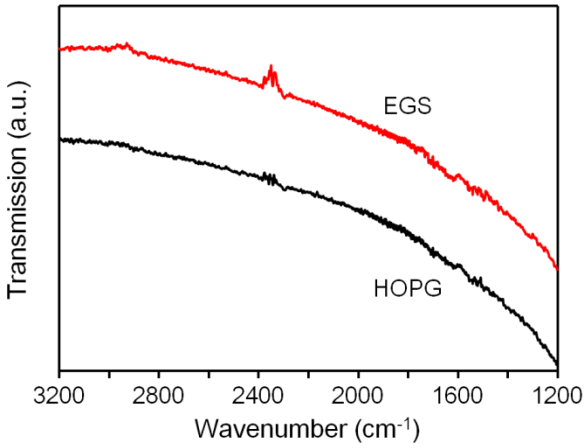

Figure S7 FTIR-ATR spectra of HOPG and the dried EGS paper. No functional groups signals can be observed from 1200 to 3200 cm^{-1}.

Section H. Thermal stability analysis of HOPG and the EGS

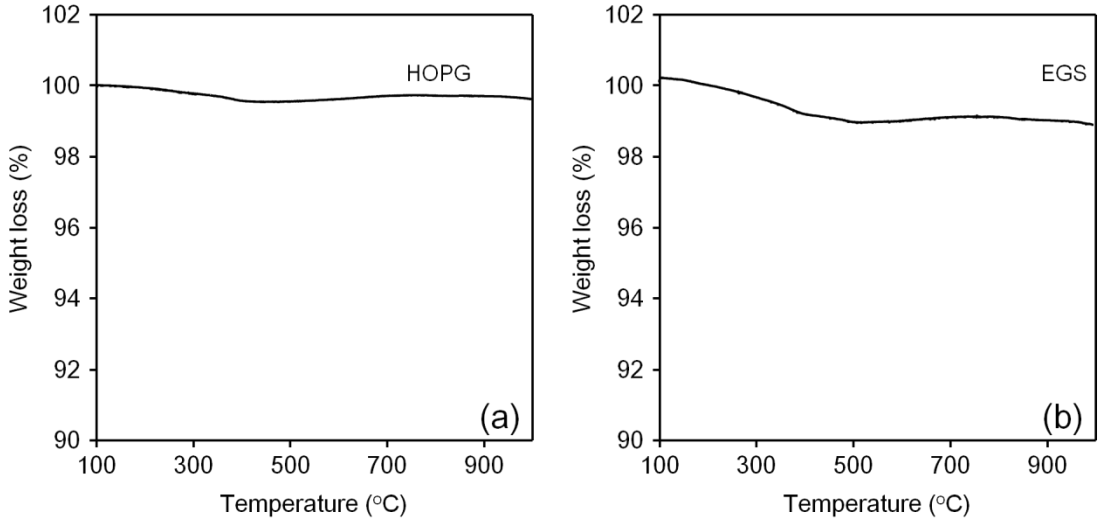

Figure S8. TGA curves of the (a) pristine HOPG and (b) EGS. The weight loss is shown as a function of temperature. The heating rate was 10 ℃/min from 100 ℃ to 1000 ℃ in N_2 atmosphere.

Section I. Electrical characterization of the conducting graphene paper.

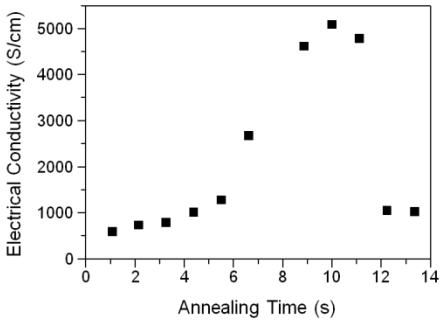

Figure S9. The electrical conductivity of the EGS paper as a function of annealing time.

Section J. Effect of Py^+ on graphene yield

Table S1 Effect of Py^+ on graphene yield

Stabilizer	Stabilizer conc.	HOPG conc. (mg/mL)	Final graphene conc. (mg/mL)	Yield (%)
Pyridinium salt	1M	0.2	0.04	75