Supporting Information

High Resolution Separation of Graphene Oxide by Capillary Electrophoresis

GO sheets normally carry with negative charge (pH > 4) due to the dissociation of carboxylic groups:

$$\mathrm{GOH} \underset{}{\overset{K_A}{\rightleftharpoons}} \mathrm{GO^-} + \mathrm{H^+} \tag{S1}$$

and

$$K_A = \frac{\left[\mathrm{GO^-}\right]\left[\mathrm{H^+}\right]_{local}}{\left[\mathrm{GOH}\right]} \tag{S2}$$

The local concentration and the bulk concentration of proton can be found with the help of the Boltzmann factor (k_B):

$$\left[\mathrm{H^+}\right]_{local} = \left[\mathrm{H^+}\right] \cdot e^{-\frac{e\psi_0}{k_B T}} \tag{S3}$$

We have the surface potential of ψ_0 [1]

$$\psi_0 = 2.30 \cdot \frac{RT}{F_A} \cdot \left(\mathrm{p}K_A - \mathrm{pH}\right) + 2.30 \cdot \frac{RT}{F_A} \log \frac{\left[\mathrm{GO^-}\right]}{\left[\mathrm{GOH}\right]} \tag{S4}$$

The surface charge density (σ) was obtained according to Grahame equation:

$$\sigma = \frac{4\varepsilon_0 \varepsilon_R k_B T \kappa}{e} \sinh \frac{e\psi_0}{2k_B T} \tag{S5}$$

where ε_0 , ε_R are dielectric permittivity coefficients of the vacuum and solution system, respectively. κ is the inverse of Debye length (λ_D)of surface potential

$$\lambda_D = \frac{1}{\sqrt{\frac{e^2}{\varepsilon\varepsilon_0 k_B T} \sum_i c_i^0 Z_i^2}} = \kappa^{-1} \tag{S6}$$

When the surface potential was low ($\psi_0 < 50$ mV), eq 5 can be simplified as[1] :

$$\sigma = \frac{2\varepsilon\varepsilon_0\psi_0}{\lambda_D} \quad \text{(S7)}$$

So surface charged GO sheets can be described as a flat slab with two faces using theory of electric double layer.

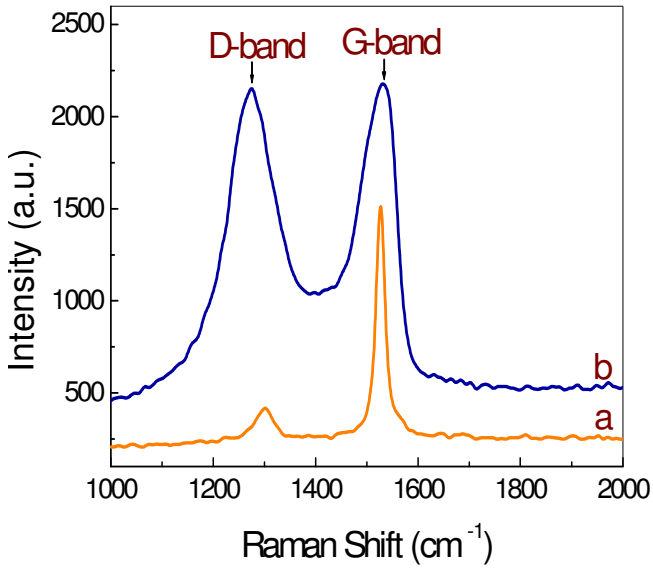

Figure S1. Raman spectra of graphite (a) and graphene oxide (b). These spectra are obtained with E_{laser} =2.41eV (514 nm).

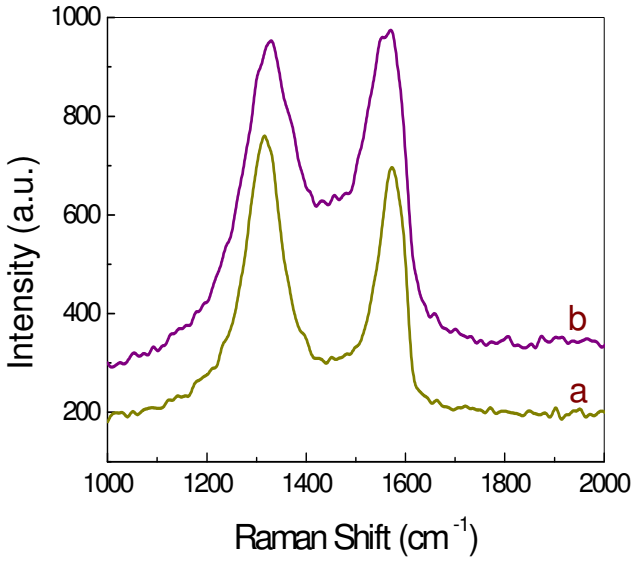

Figure S2. Raman spectra taken at 514nm of GO fractionations obtained at the anode (a) and the cathode (b), respectively.

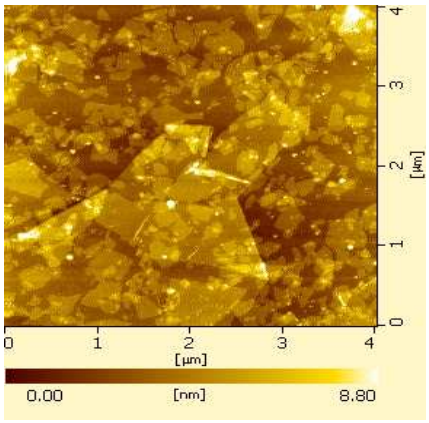

Figure S3. AFM image of the GO sample used for the separation study. The sample is polydisperse with sizes varying from a few nanometers to micrometers.

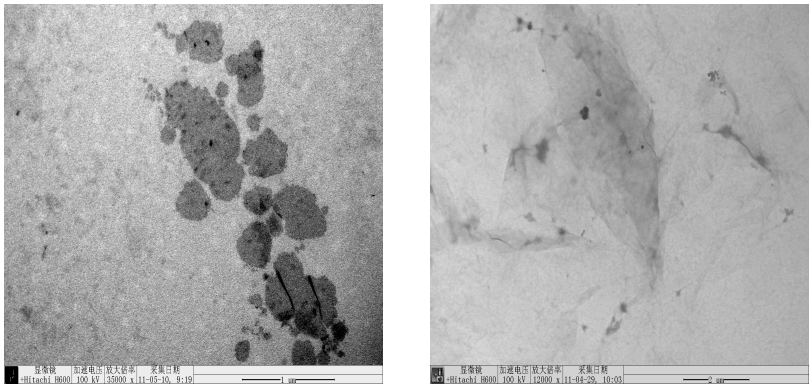

Figure S4. TEM images of the GO sample obtained at the anode (left) and cathode (right), respectively.

Reference

(1) Butt, H.-J.; Graf, K.; Kappl, M.; WILEY-VCH Verlag GmbH & Co. KGaA: Weinheim, 2003.