Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Regulation of radicals from electrochemical exfoliation of double-graphite electrode to fabricate high-quality graphene

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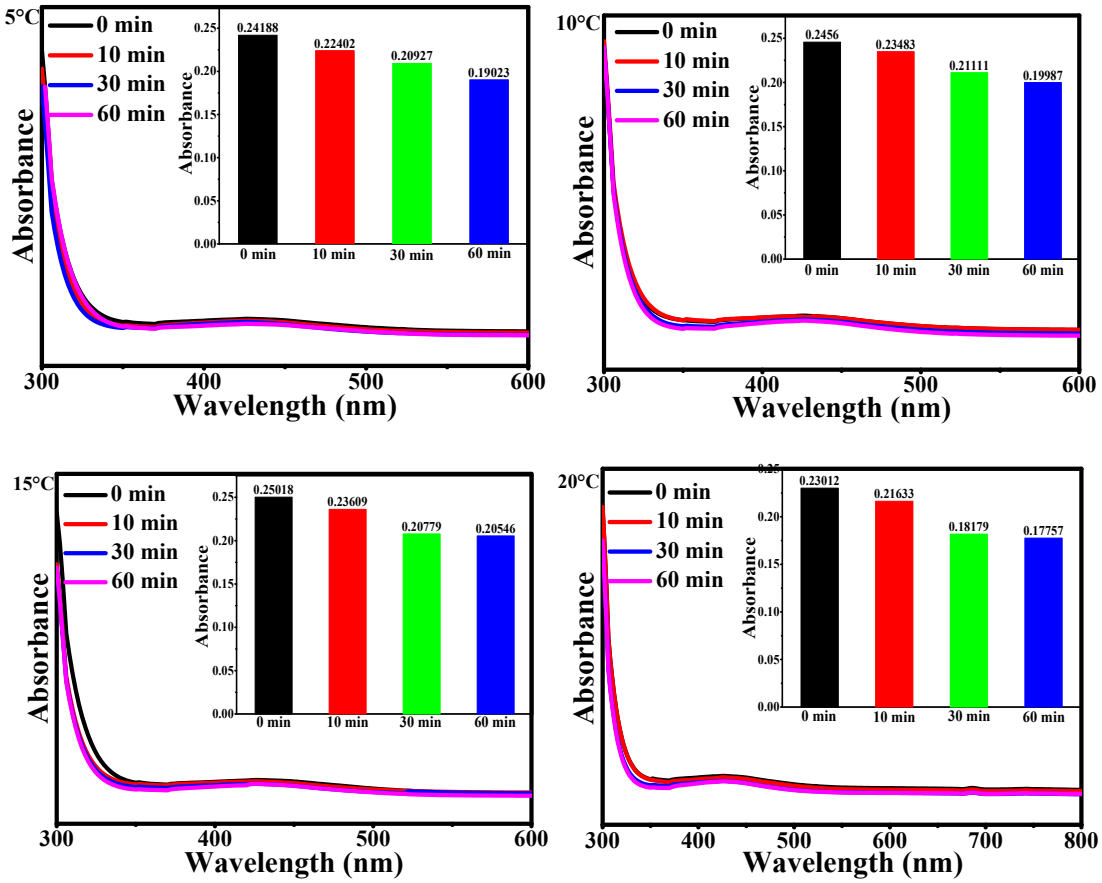


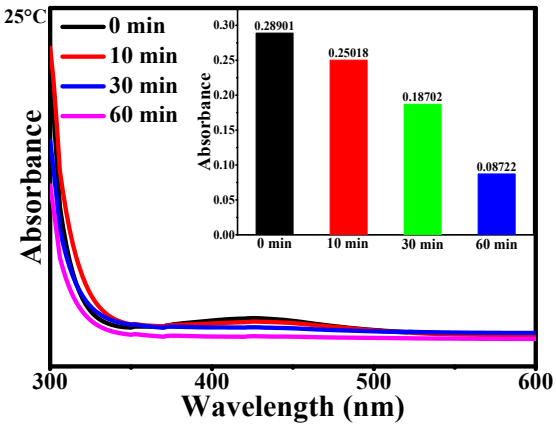
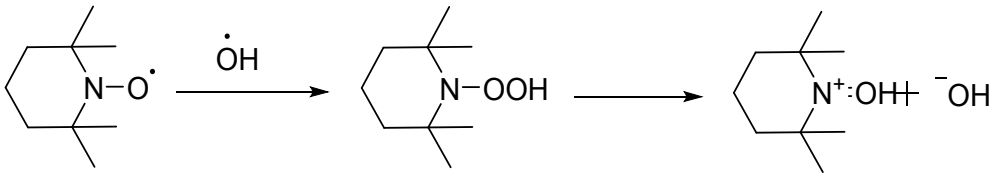


Figure S1 UV-vis spectra of 1 mg mL^{-1} TEMPO in 0.1 M ammonium sulfate aqueous solution after applying alternating current (±10 V, every 20 seconds from positive (+10 V) to negative (-10 V)) for 0 min, 10 min, 30 min and 60 min (Graphite foils were used as working electrode and counter electrode).



TEMPO

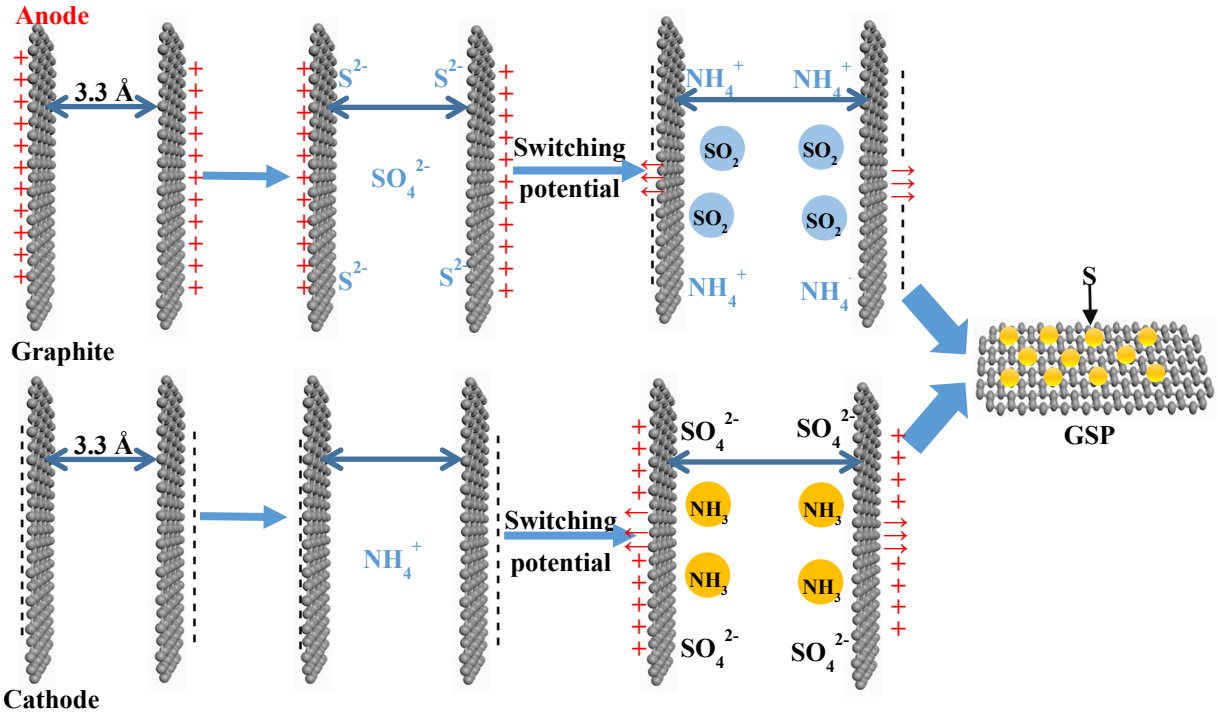


Figure S2. Schematic illustration of the electrochemical exfoliation of double graphite foil and the formation of GSP.

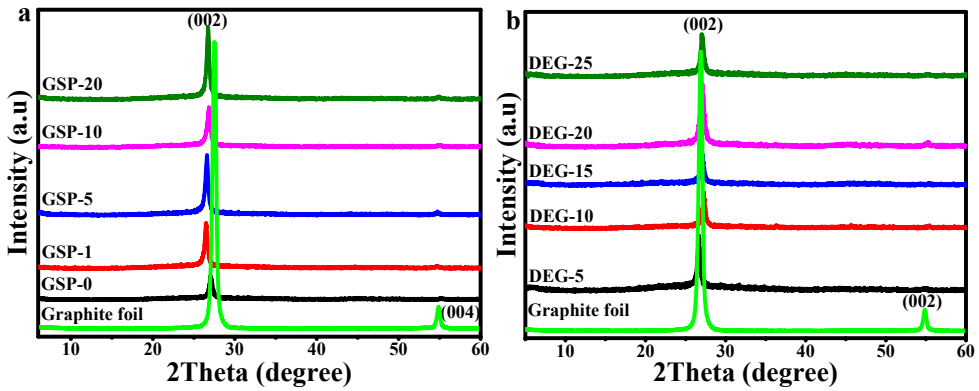


Figure S3. XRD patterns of GSP (a) and DEG (b).

Analytical techniques and characterization

The power X-ray diffraction (XRD) analyses were obtained on a XRD-6000 (Japan) spectrometer with Cu Ka (λ = 0.154 nm) radiation at 40 kV and 15 mA. The diffraction data was executed in the range of 2θ = 5~60º with a scan speed of 10ºmin-1. X-ray photoelectron spectroscopy (XPS) analysis was measured at room temperature on an Thermo Fisher ESCALAB after plasma cleaning for 300 s in the XPS chamber at a pressure of around 4×10^{-8} torr. The XPS spectra were peak-differentiated and imitated using the XPS peak 4.1 software in which a shirley background was assumed. The morphological characteristics of graphene were obtained by using SEM Quanta F250 and JEM-2100 transmission electron microscope (Japan Electron Optics Labortary Co., Ltd., JEOL) with an accelerating voltage of 200 kV.

The samples were measured according to their EMI SE characterization in a frequency range of 8-12 GHz (X-band) using the waveguide method via the vector network analyzer (HP8720ES8720ES). The S parameters (S11 and S21) of each sample were recorded and were then used to calculate the EMI SE. The parameter S11 symbolizes the tested reflection coefficient data, and S21 stands for the transmission data. Because of the negative values of the measured S11 and S21, the values of the |S11| and |S21| were identified as the attenuations of reflection and transmission in the incident electromagnetic waves, respectively. The power coefficients of reflection (R), transmission (T), and absorption (A) were evaluated based on the following equations [1-5]: $R=\left|S_{11}\right|^2, T=\left|S_{21}\right|^2,$

$$A = 1 - R - T \quad (1)$$

Here, the absorption coefficient is given in terms of the power of the incident wave. After the first reflection, the relative intensity of the effective incident wave inside the material is (1-R). Therefore, the coefficient of effective absorbance (Aeff) can be defined as follows: $A_{eff} = (1 - R - T)/(1 - R)$ (2)

The total EMI SE (SET) is also composed of three parts, including reflection (SER), absorption (SEA), and multiple reflections (SEM). The SET can be simplified as follows [1,3]: $SE_T = SE_R + SE_A + SE_M \approx SE_R + SE_A$ (3)

Because of its reflectance and effective absorbance, the EMI SE can be described as follows [3-5]: $SE_R = -10\,log\,(1 - R)$ (4)

$$SE_A = -10\,log\,(1 - A_{eff}) = -10\,log\left(\frac{T}{1 - R}\right) \quad (5)$$

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