

Supporting Information for

What Is the Choice for Supercapacitors: Graphene or Graphene Oxide?

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EXPERIMENTAL SECTION

All chemicals including graphite powder (200-325 mesh) were purchased from Beijing Chemical Reagents Company with their purity being of analytical grade. All chemicals were used without further purification. Graphene oxide and graphene were synthesized by the modified Hummers's method reported elsewhere.³³ The products were characterized using a S4800 field-emission scanning electron microscope at 5-15 kV and JEOL JEM-2010 high-resolution transmission electron microscope at 200 kV. X-ray photoelectron spectroscopy (XPS) was performed using a Sigma Probe spectrometer with a high-performance Al monochromatic source operated at 15 kV. The XPS spectra were taken after all binding energies were referenced to the C 1s neutral carbon peak at 284.8 eV, and the elemental compositions were determined from peak area ratios after correction for the sensitivity factor for each element. Raman spectra were recorded on a Renishaw system 1000 with a 50 mW He-Ne laser operating at 514 nm with a CCD detector. The final spectrum presented is an average of 10 spectra recorded at different regions over the entire range of the sample. Infrared spectra were recorded on a Magna-IR 750 system by using powder samples. Nitrogen sorption measurements were performed with ASAP 2020 (Micromeritics, USA) to obtain pore properties such as the BET-specific surface area, pore size distribution, and total

pore volume. Before measurement, the sample was outgassed under vacuum at 250 °C for ca. 12 h until the pressure less than 5 µmHg. X-ray powder diffraction data were collected with an X'Pert Pro MPD (PANalytical, The Netherlands) diffractometer using monochromatic Cu Kα1 radiation ($\lambda = 1.5406 \text{ \AA}$) at 40 kV and 40 mA. The diffraction patterns were optimized with a step length of 0.01° (2θ) over an angular range $5\text{-}70^\circ$ (2θ) with a scanning speed of $0.01^\circ/\text{s}$. [A Keithley 4200 Semiconductor Characterization System was used to measure the electrical conductivities \(four-probe method\) of the samples.](#)

The electrochemical performances of the graphene oxide and graphene were measured in a [symmetrical](#) two-electrode cell. The electrodes were prepared by pressing a mixture of 87 wt% of sample, 10 wt% of acetylene black and 3 wt% of PTFE binder into pellets (11 mm in diameter) and then drying at 120 °C for 12 h. [The mass loading of the graphene oxide or graphene is ~0.015 g in each electrode.](#) The capacitor was assembled into two-electrode system, among which two electrodes were [same in both composition and mass](#), separated by polypropylene membrane using 6 mol L^{-1} KOH aqueous solutions as electrolyte. The cyclic voltammetry (CV) and ac impedance spectroscopy (EIS) were recorded by Solartron 1280B electrochemical workstation. The frequency range for the impedance spectra was from 0.05 Hz to 20 kHz with $\pm 10\text{mV}$ voltage amplitude. Equivalent series resistance (ESR) was measured at 1 kHz. The galvanostatic charge/discharge test was carried out on an Arbin cell tester (CT2001A) between 0 and 1 V. The specific capacitance (C) of a single electrode was determined with the formula $C = 2It / \Delta Vm$, where I is the discharge current (A), t is the discharge time (s), ΔV is the potential change in discharge (V) and m is the mass of the active material in a single electrode (g).

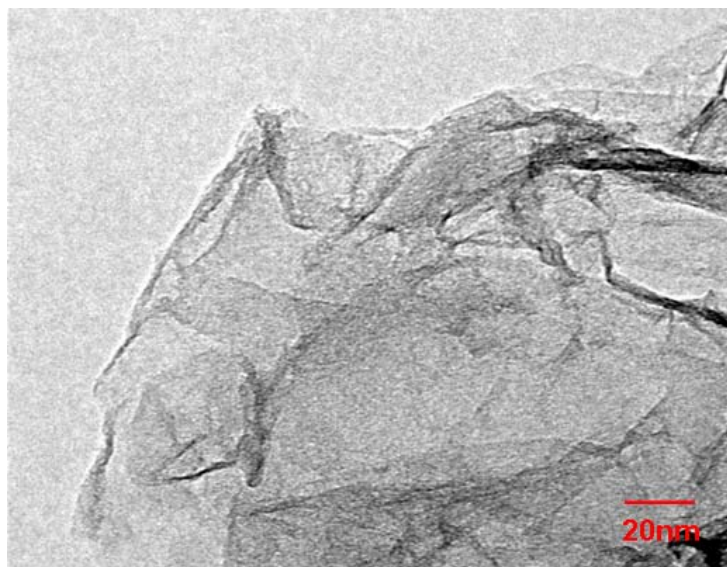


Fig. S11 TEM image of graphene.

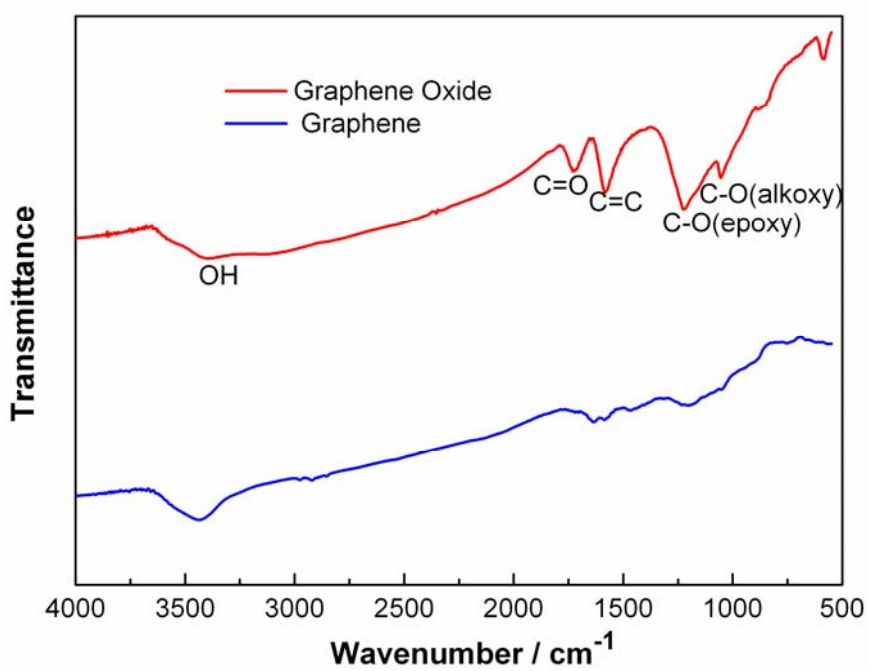


Fig. S12 IR spectra of graphene oxide and graphene.

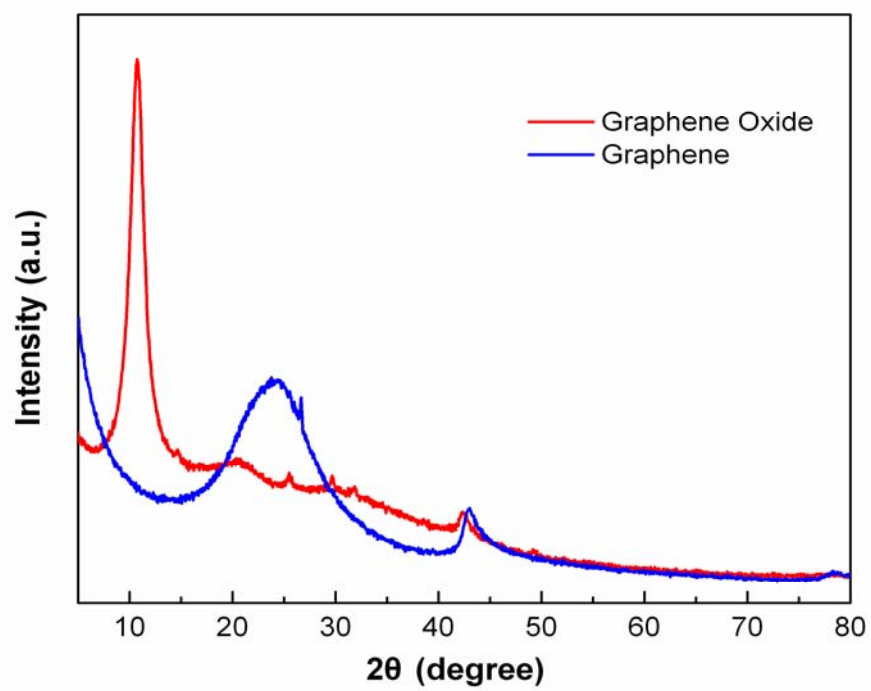


Fig. SI3 XRD profiles of graphene oxide and graphene.