Supporting Information for

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

Bin Xu,*[a] Shufang Yue,[b] Zhuyin Sui,[c] Xuetong Zhang,*[c] Shanshan Hou,[b] Gaoping Cao[a] and Yusheng Yang[a]

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 (λ = 1.5406 Å) at 40 kV and 40 mA. The diffraction patterns were optimized

with a step length of 0.01° (2θ) over an angular range 5-70° (2θ) with a scanning speed of

0.01°/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 ±10mV 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

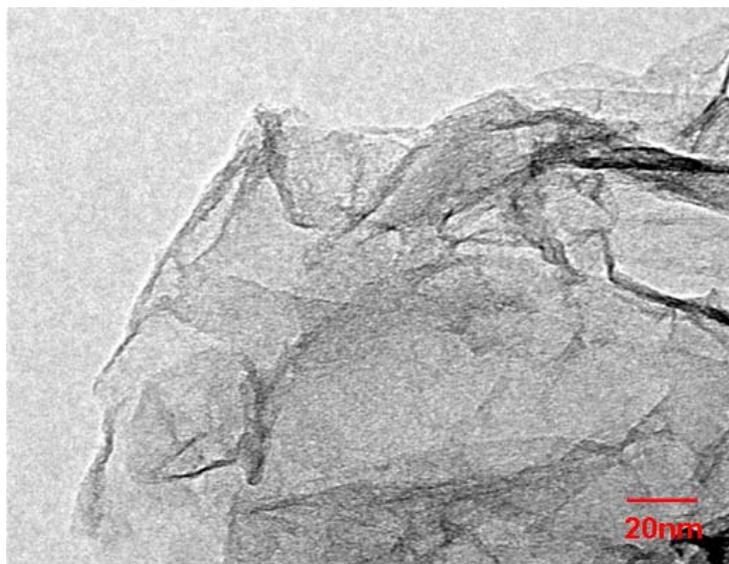active material in a single electrode (g).
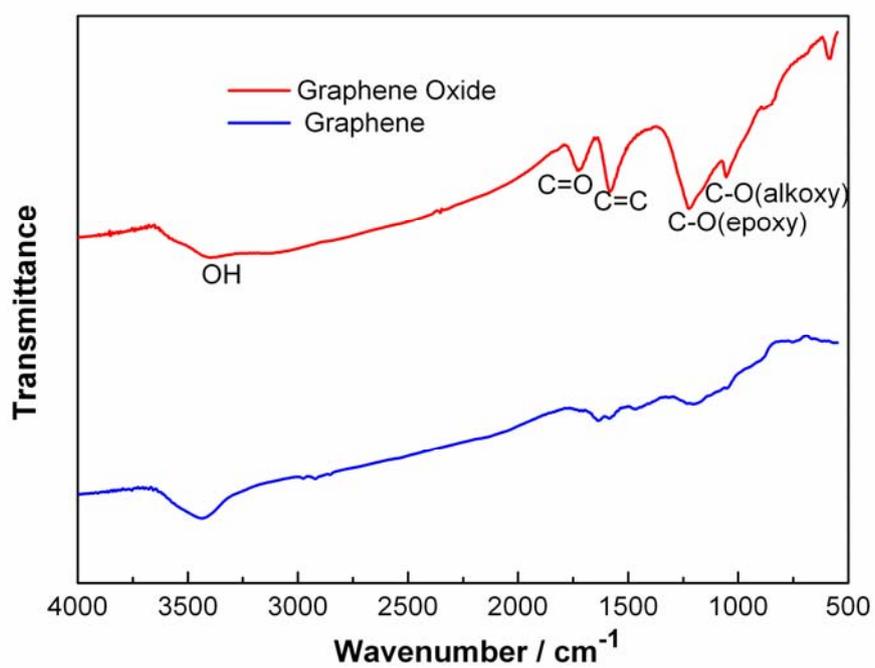
Fig. SI1 TEM imagine of graphene.
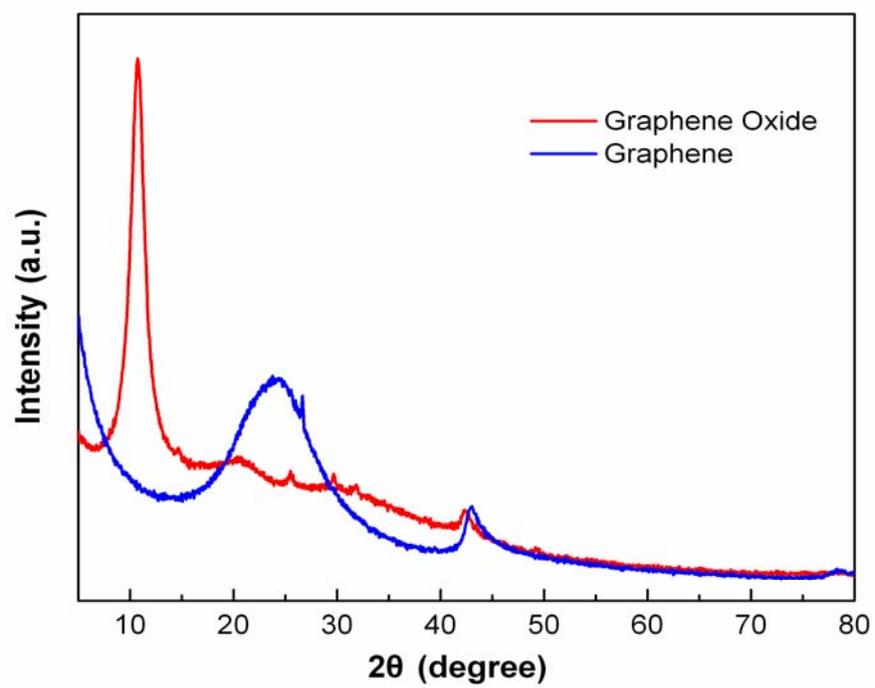

Fig. SI2 IR spectra of graphene oxide and graphene.

Fig. SI3 XRD profiles of graphene oxide and graphene.