Electronic Supplementary Material (ESI) for Nanoscale.

Hierarchical Networks of Redox-Active Reduced Crumpled Graphene Oxide and Functionalized Few-Walled Carbon Nanotube for Rapid Electrochemical Energy Storage

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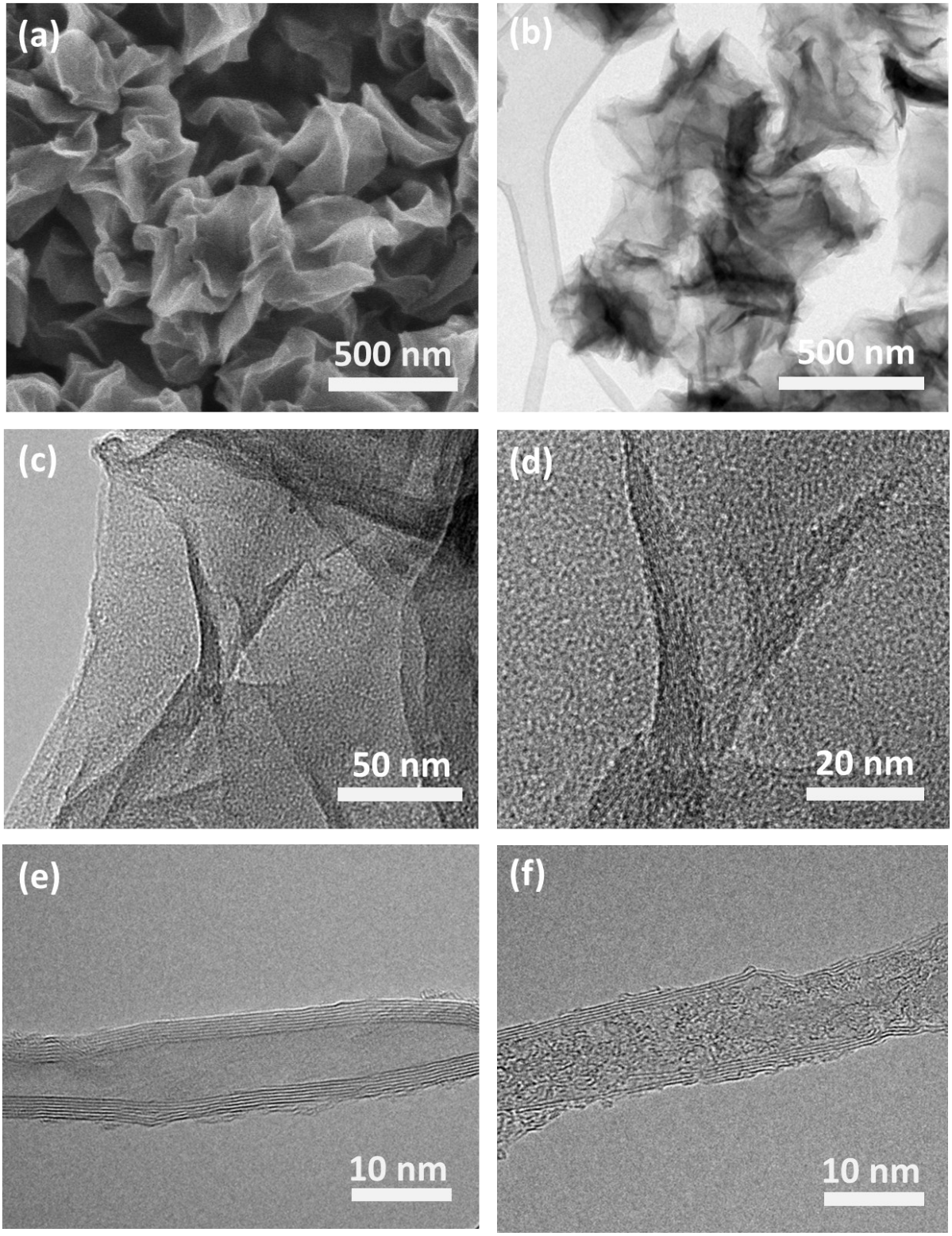

Fig. S1 (a) Scanning electron microscopy (SEM) image of the partially reduced crumpled graphene oxide (r-CGO). High resolution transmission electron microscopy (HRTEM) images of the (b, c, d) r-CGO, (e) few-walled carbon nanotube (FWNT) and (f) oxygen-functionalized (f-FWNT).

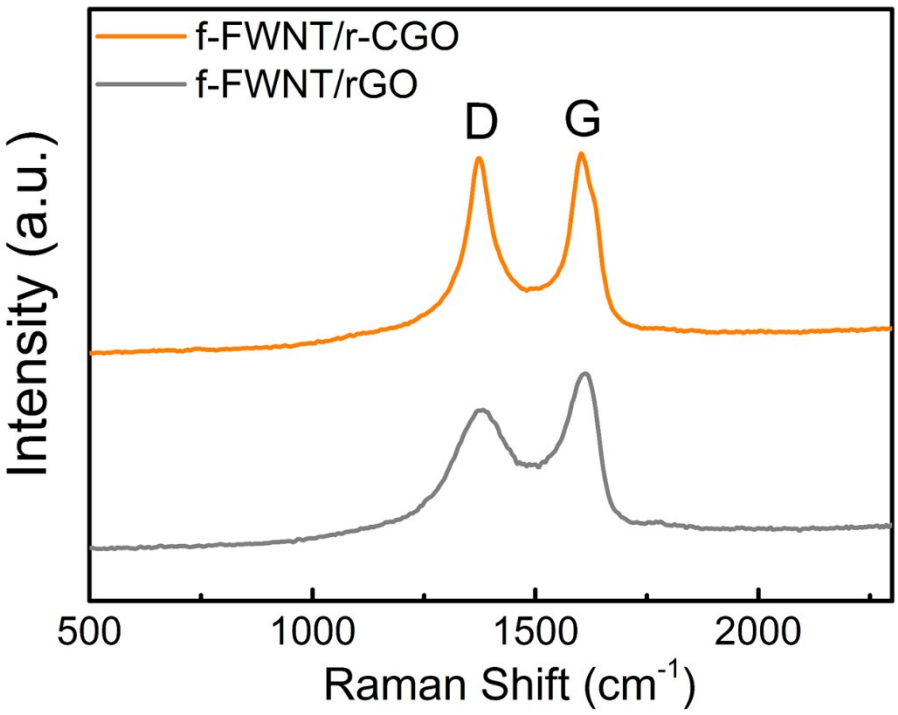

Fig. S2 Raman spectra of the f-FWNT/r-CGO and f-FWNT/rGO electrodes.

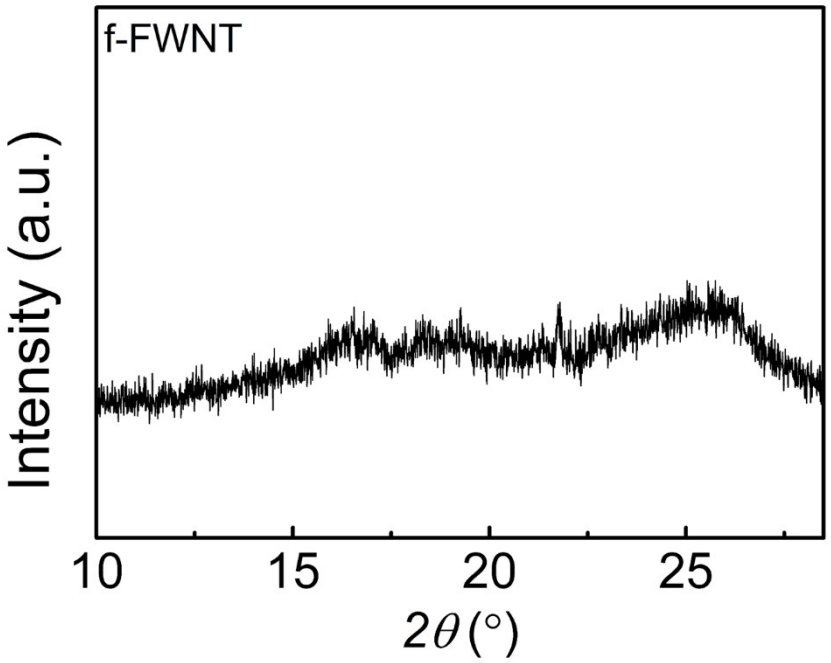

Fig. S3 X-ray diffraction (XRD) investigation of the f-FWNT electrode.

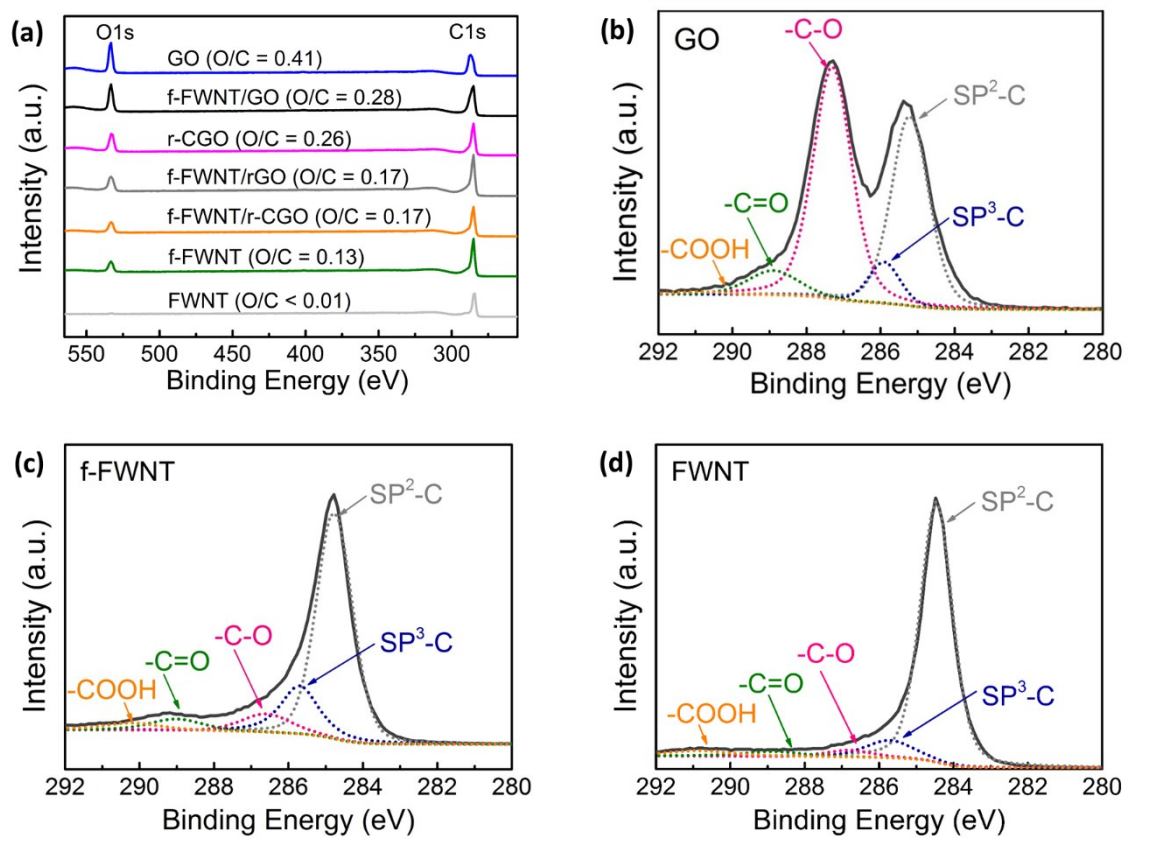

Fig. S4 X-ray photoelectron microscopy (XPS) (a) wide scan survey of the electrodes and r-CGO powder. High resolution C1s spectra of (b) the GO, (c) f-FWNT and (d) FWNT.

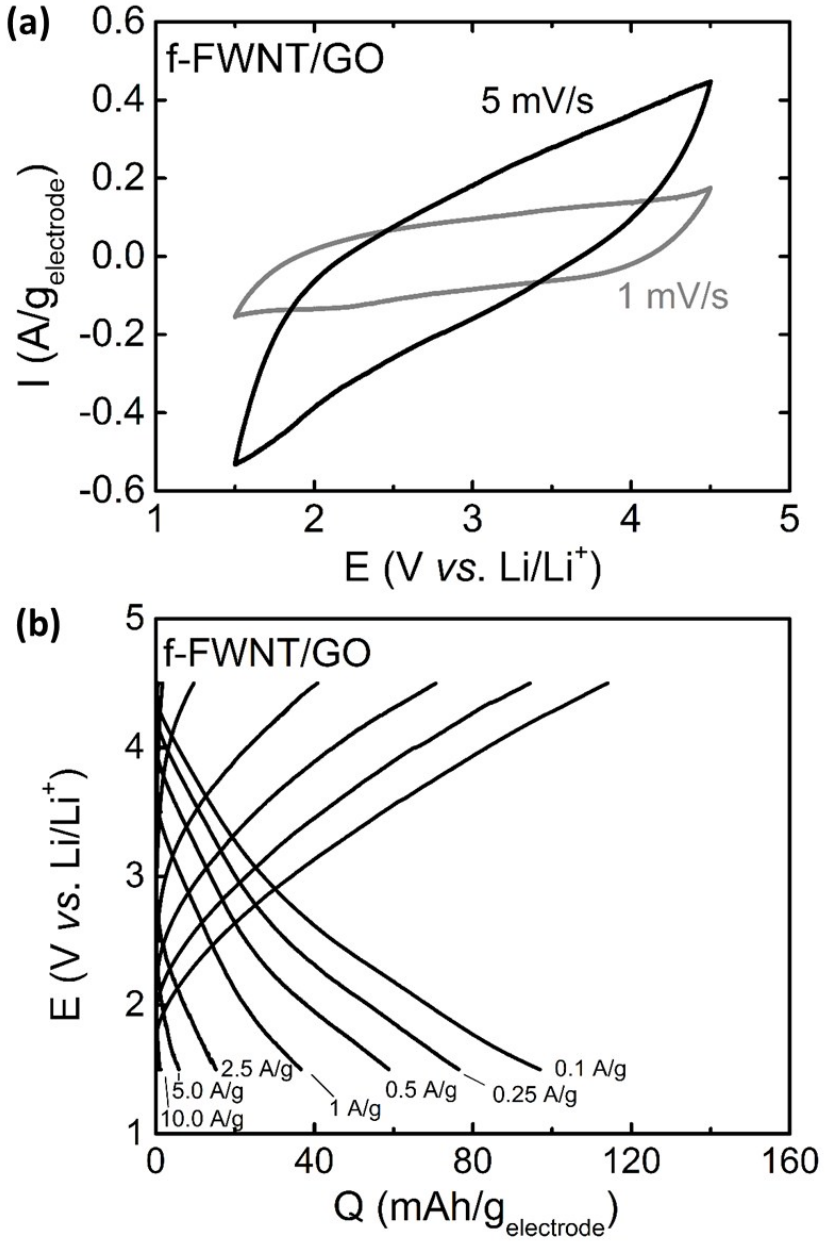

Fig. S5 (a) Cyclic voltammetry (CV) scans of the f-FWNT/GO composite electrode at scan rates of 1 mV/s and 5 mV/s in the voltage window of 1.5 ~ 4.5 V vs. Li/Li^+. (b) Galvanostatic rate-dependent discharge and charge profiles of the f-FWNT/GO electrode.

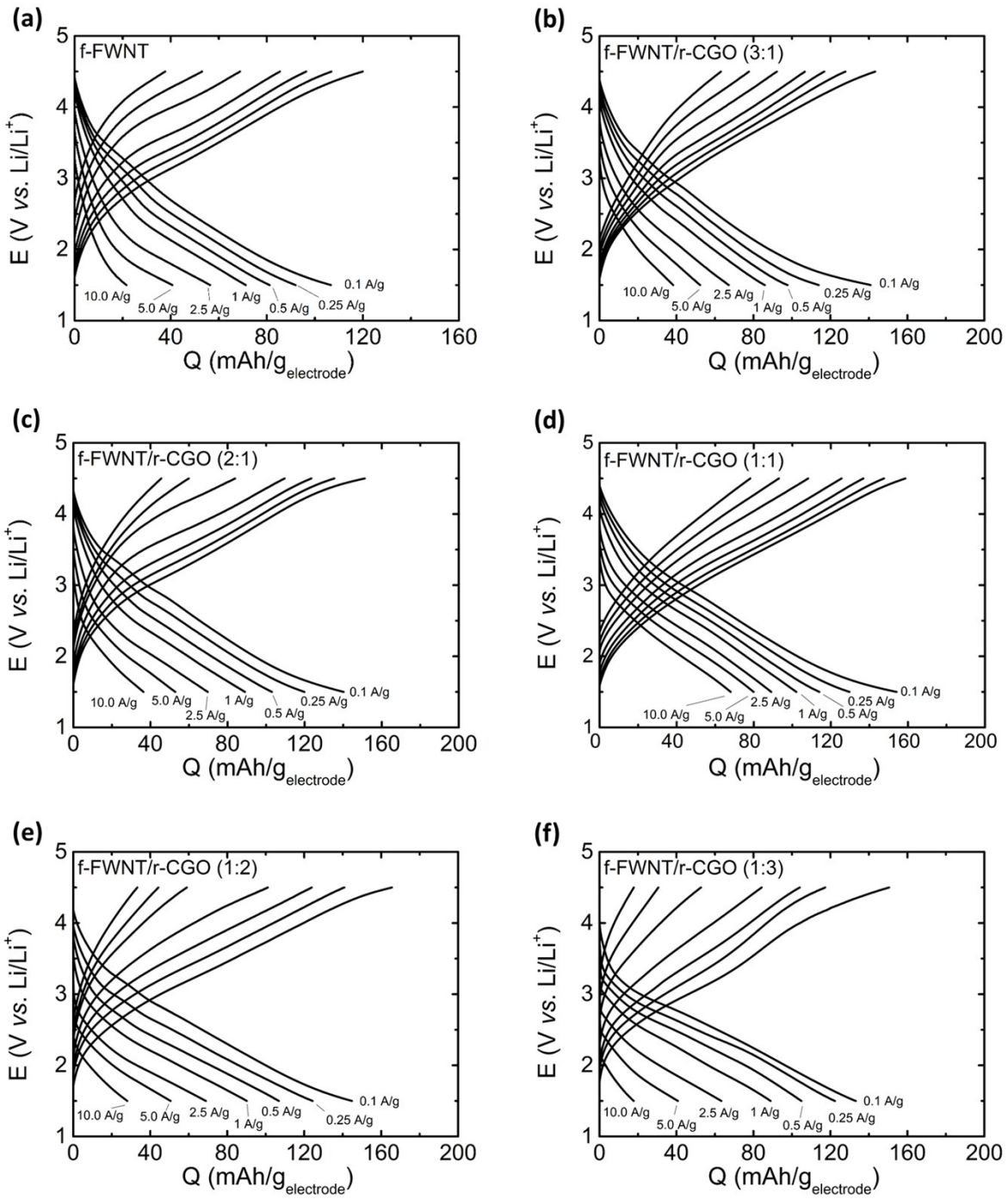

Fig. S6 Galvanostatic rate-dependent discharge and charge profiles of the f-FWNT/r-CGO electrodes with various mass ratios. (a) Pristine f-FWNT (1:0), (b) 3:1, (c) 2:1, (d) 1:1, (e) 1:2 and (f) 1:3.

Table S1 Capacity comparison of free-standing carbon based cathodes.

Materials(Thickness)	Voltage window	Capacity based on the mass of the electrode	Reference
f-FWNT/C-rGO (30 μm)	**1.5-4.5V**	**170 mAh/g at 0.1 A/g**	**This work**
folded-graphene film (51 μm)[1]	1.5-4.5 V	160 mAh/g at 0.1 A/g	*Chem. Mater.,* **2015**, 27, 3291–3298
Oxidized CNT + graphene oxide composite electrode (4 μm)[2]	1.5-4.5 V	135 mAh/g at 0.1 A/g	*Adv. Funct. Mater*., **2013,** 23, 1037-1045.
Functionalized CNT (3.6 μm)[3]	1.5-4.5 V	117 mAh/g at 0.05 A/g	*Energy Environ. Sci*., **2013,** 6, 888-897.
Oxidized CNT (15 μm)[4]	1.5-4.5 V	118 mAh/g at 0.1 A/g	*Energy Environ.Sci*., **2012,** 5 , 5437-5444
Reduced graphene oxide(2.5 μm)[5]	1.5-4.5 V	125 mAh/g at 0.137 A/g	*ACS Appl. Mater. Interfaces*, **2013,** 5 , 12295-12303.
Biomass-derived carbon + FWNT[6]	1.5-4.5 V	150 mAh/g at 0.1 A/g	*Nanoscale*, **2016**, 8, 3671-3677.

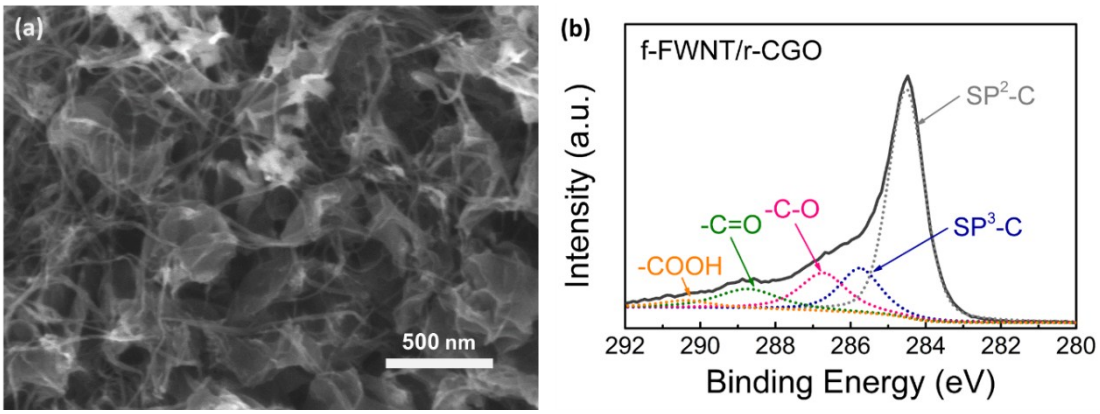

Fig. S7 (a) SEM image of the f-FWNT/r-CGO electrode after 3000 cycles. (b) XPS high resolution C1s spectra of the f-FWNT/r-CGO after 3000 cycles.

References

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