Electronic Supplementary Information

Conformally Deposited NiO on a Hierarchical Carbon Support for High-Power and Durable Asymmetric Supercapacitor

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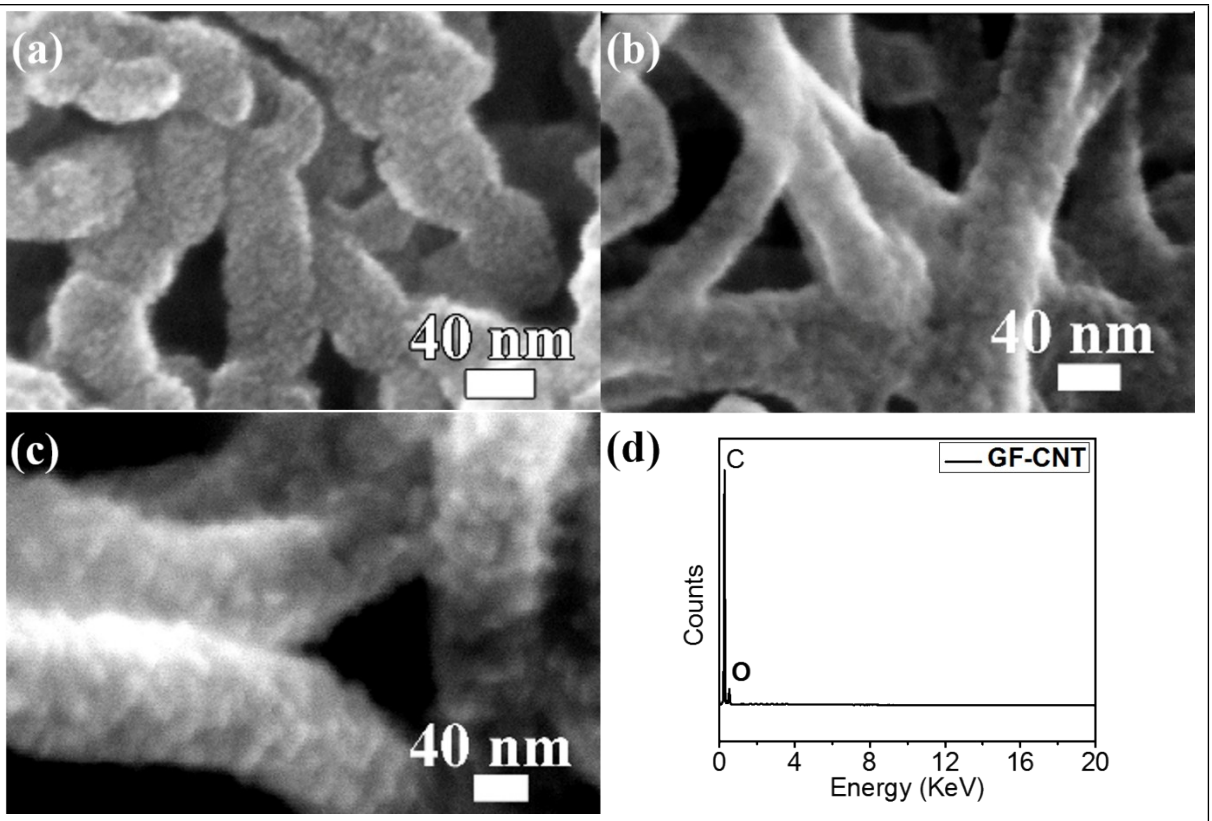

Figure S1. SEM images of ALD NiO on GF-CNT with (a) 300, (b) 600, and (c) 900 cycles, respectively. (d) EDS result of GF-CNT substrate.

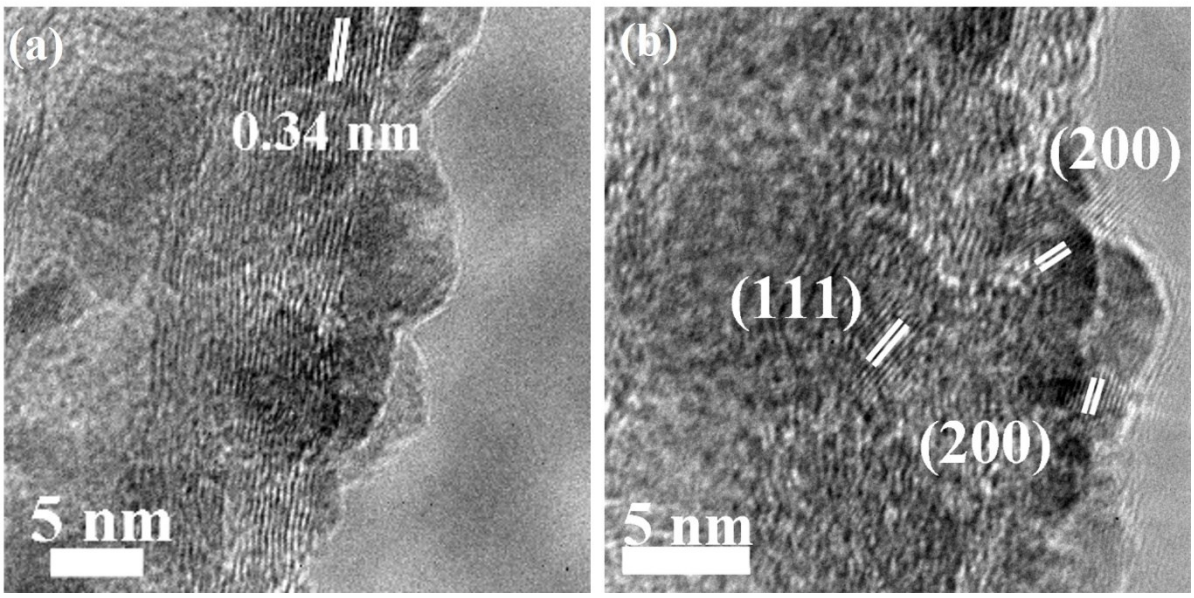

Figure S2. HRTEM images of GF-CNT@NiO.

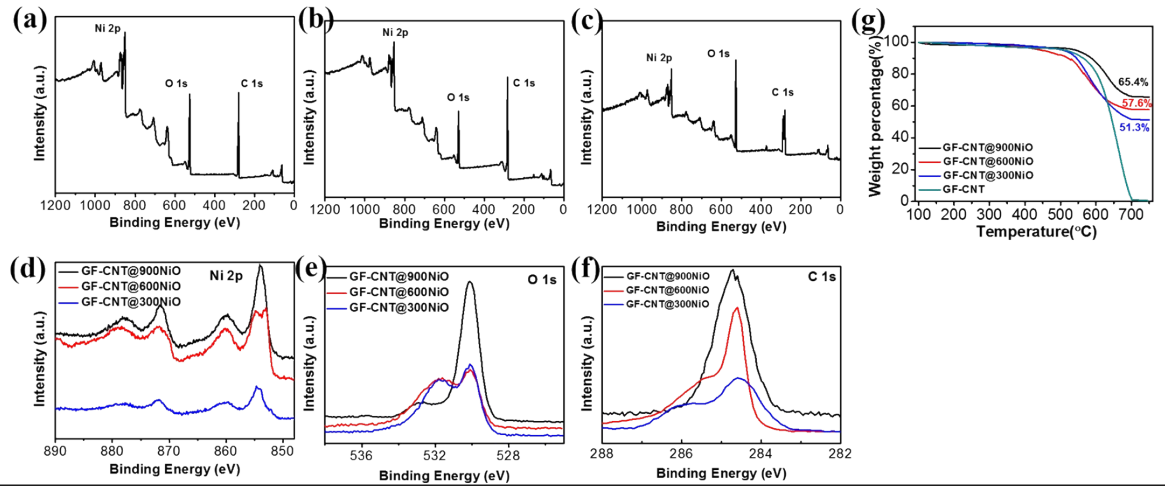

Figure S3. (a-c) XPS results of GF-CNT@900NiO, GF-CNT@600NiO, and GF-CNT@300NiO, respectively. (d-f) Detailed comparison of the Ni 2p, O 1s, and C is spectra of the three samples. (g) TGA result of GF-CNT@NiO and GF-CNT.

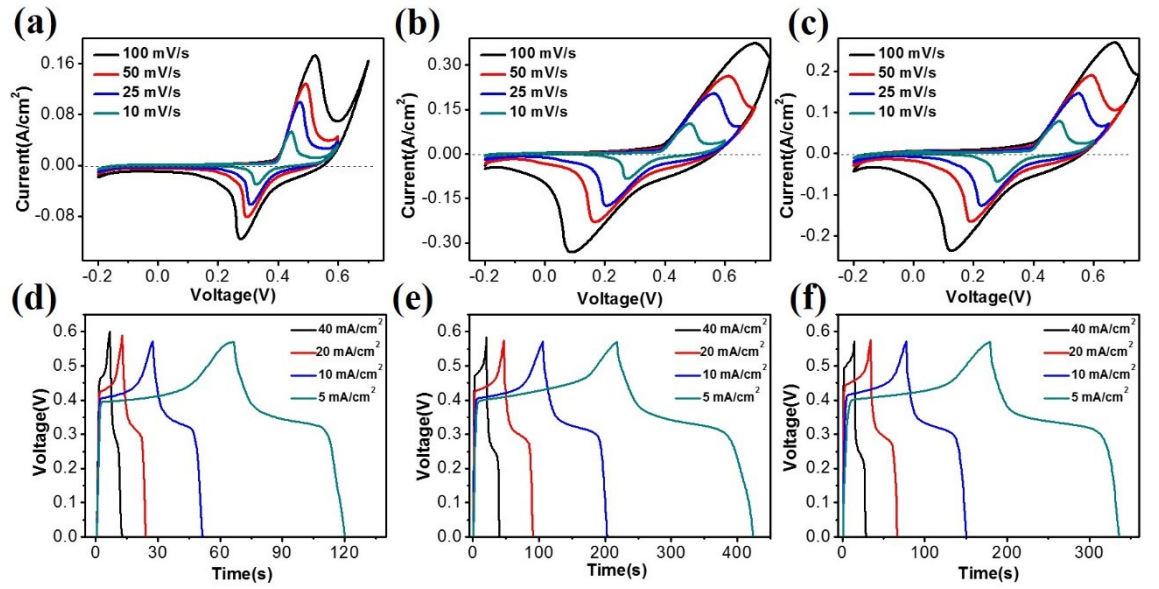

Figure S4. CV and charge-discharge curves of (a, d) GF-CNT@300NiO, (b, e) GF-CNT@600NiO, and (c, f) GF-CNT@900NiO, respectively.

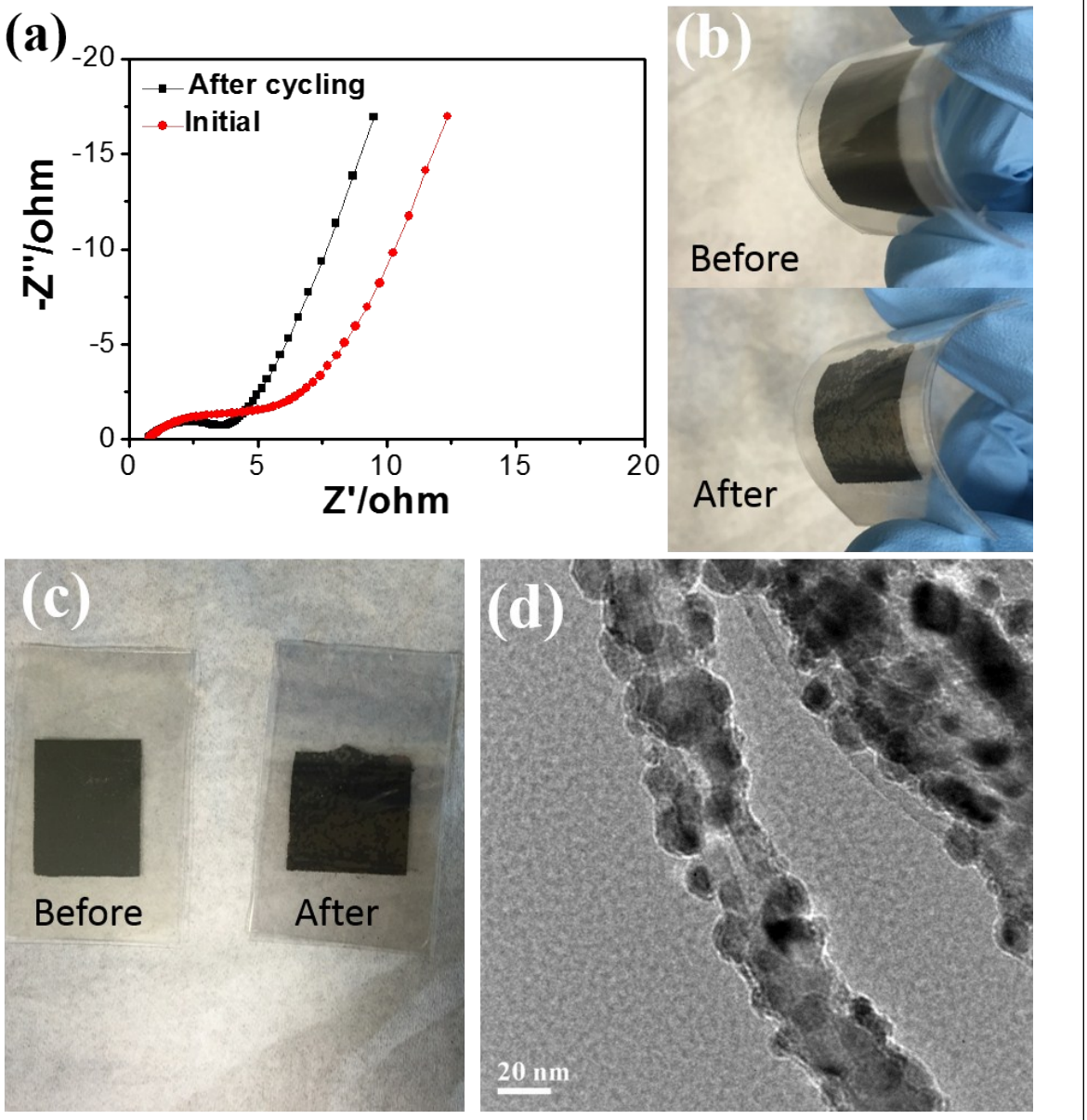

Figure S5. (a) EIS results of GF-CNT@NiO//G-CNT full-cell before and after the cycling test. (b-c) digit photos of GF-CNT@NiO electrodes before and after the cycling test. (e) TEM image of GF-CNT@NiO after the cycling test.

Table S1. NiO and $Ni(OH)_2$ based asymmetric supercapacitor

NiO or $Ni(OH)_2$ electrode					Asymmetric supercapacitor				
Structure	Method	Loading mass per electrode	Capacitancy /Capacity	Cycling	Anode	Power density	Energy density	Cycling	Year
NiO[a]	Solvent thermal	5 mg/ cm^2			Active carbon	0.08 Wh/kg at 0.1 A/g	26.1 Wh/kg at 0.1 A/g	86% after 800 cycles	2006[1]
NiO powder[a]	calcinations	10 mg/ cm^2	310 F/g at 6 mA/cm^2		$Ru_{0.36}V_{0.64}O_2$	1.42 kW/kg at 23.0 Wh/kg	41.2 Wh/kg	83.5% after 1500 cycles	2007[2]
NiO[a]	Solvent thermal	8 mg/ cm^2	2080 F/g at 5 mA/cm^2		Active carbon	1.1 kW/kg at 26.9 Wh/kg	42.3 Wh/kg at 0.11 kW/kg	82% after 1000 cycles	2010[3]
$Ni(OH)_2$/G[a]	Microwave heating	3 mg/cm^2	1735 F/g at 1 mV/s		porous graphene	15.2 kW/kg at 13.5 Wh/kg	77.8 Wh/kg at 0.175 kW/kg	94.3 % after 3000 cycles	2012[4]
$Ni(OH)_2$/CNT/Nickel foam[b]	chemical bath deposition		3300 F/g at 1 mV/s		Active carbon	1.8 kW/kg at 32.5 Wh/kg	50.6 Wh/kg at 0.095 kW/kg	83 % after 3000 cycles	2012[5]
$Ni(OH)_2$/ ultrathin-graphite foam	hydrothermal	0.2 mg/cm^2	166 F/g at 0.5 A/g	65% at 1000 cycles	Activated microwave exfoliated graphite oxide	85 kW/kg at 6.5 Wh/kg	13.4 Wh/kg at 65 kW/kg	63.2% after 10 000 cycles	2013[6]
NiO nanoflake/ carbon cloth[b]	solvothermal	2.7 mg/cm^2	392 F/g at 0.5 mA/cm^2		rGO sheets on Ni foam	~3 kW/kg at ~14 Wh/kg	39.9 Wh/kg at ~0.2 kW/kg	95 % after 3000 cycles	2013[7]
$Ni(OH)_2$ powder[a]	chemical coprecipitation	12 mg/ cm^2	680 F/g at 1 mV/s		Porous VN	2.4 kW/kg at 26 Wh/kg	50 Wh/kg at 0.365 kW/kg	85% after 1000 cycles	2013[8]
amorphous $Ni(OH)_2$ nanospheres	Electrochemical method	0.12 mg/ cm^2	2188 F/g at 1 mV/s	76% after 10 000 cycles	Active carbon	1.67 kW/kg at 12.6 Wh/kg	35.7 Wh/kg at 0.49 kW/kg	81% after 10 000 cycles	2013[9]
NiO-3D graphene foam	Pulsed laser deposition		1225 F/g at 2 A/g	89% at 1000 cycles	nitrogen-doped carbon nanotubes	42 kW/kg at 17 Wh/kg	32Wh/kg at 0.7 kW/kg	94% after 2000 cycles	2014[10]
GF-CNT@NiO	Atomic layer deposition	1.53 mg/ cm^2	196.5 mAh/g at 5 mA/cm^2	83.5% after 30 000 cycles	Graphene-CNT paper	7.14 kW/kg at 11.9 Wh/kg	23.4 Wh/kg at 1.06 kW/kg	81.7% after 30 000 cycles	Current work

a. Powder form with metal foam/ as substrate
b. Metal/carbon substrate(such as Nickel foam, carbon cloth and carbon plate) is used

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