Supporting Information

Laboratory Filter Paper as Substrate Material for Flexible Supercapacitors

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The specific capacitance of the electrode and supercapacitor was calculated from CV and GCD curves according to the following formulas:

$$C = \frac{\int i(V)dV}{2s \cdot v \cdot \Delta V} \tag{1}$$

$$C = \frac{I \cdot \Delta t}{s \cdot \Delta V} \tag{2}$$

where $\int i(V)dV$ is the integral area of the CV curve, s is the effective area of the active material coated on substrate or the volume of the cell in the supercapacitor, v is the scan rate, and ΔV is the working potential window in the CV or GCD tests; I is the discharge current.

The energy and power density (E and P) were calculated by the above-mentioned specific capacitance C and the following equations:

$$E = \frac{1}{2} C V^2 \tag{3}$$

$$P = \frac{E}{\Delta t} \tag{4}$$

where C is the volume specific capacitance, V is the potential window in the discharge process and Δt is the discharge time.

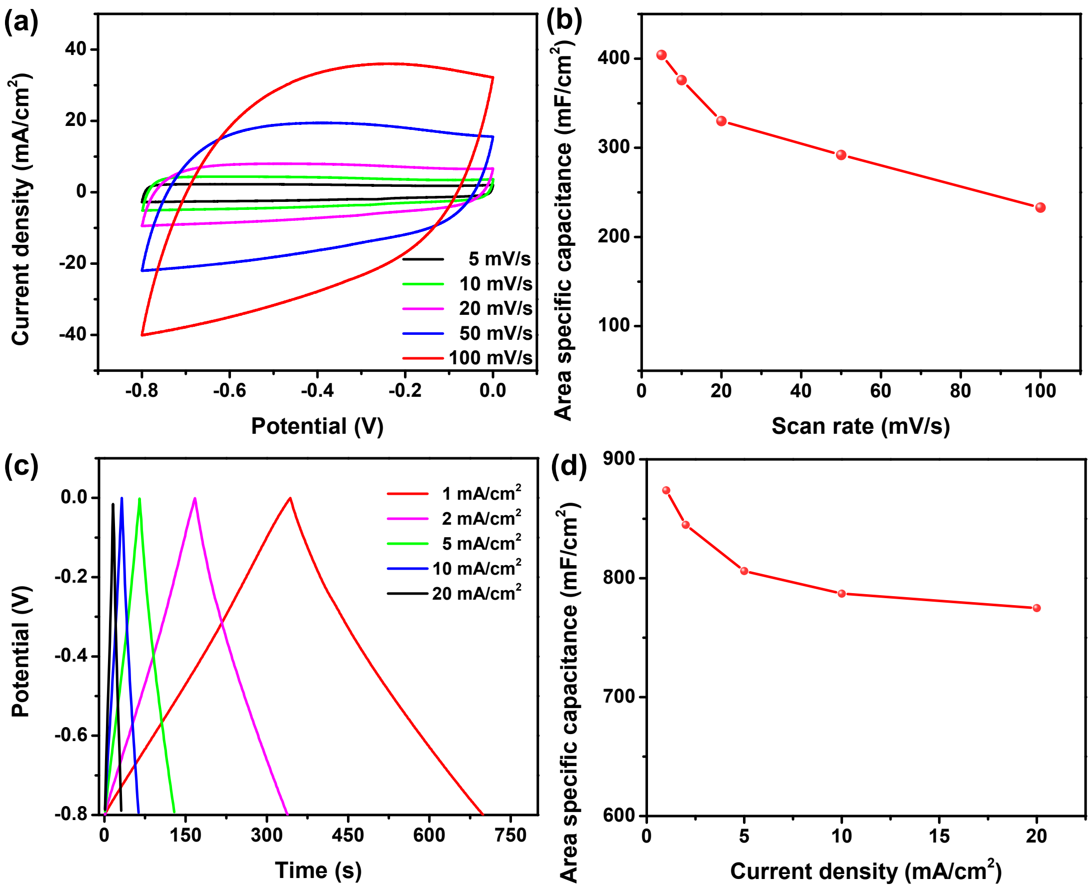

Figure S1. (a) CV curves of Ni/AC-FP electrode at scan rate of 5-100 mV/s; (b) Area specific capacitance of Ni/AC-FP electrode calculated from CV curves as function of scan rate; (c) GCD curves of Ni/AC-FP electrode at current density of 1-20 mA/cm^2; (d) Area specific capacitance of Ni/AC-FP electrode calculated from GCD curves as function of current density.

Cyclic voltammetry (CV) and galvanostatic charging/discharging (GCD) test were performed by a three-electrode configuration in 1 M KOH aqueous electrolyte to characterize the electrochemical performance of Ni/AC-FP electrode. In Figure S1a, the shapes of all CV curves with scan rate ranging from 5 to 100 mV/s are approximatively rectangle-like, obviously revealing the electric double layer capacitor (EDLC) characteristics originated from the large specific surface area of AC.

Also, the integral area and the current density of the CV curves become larger with the increase of scan rate and there are no great changes in the shape of CV curves even at high scan rate of 100 mV/s, indicating the good adhesion between AC and super electrical conductive Ni(II)-FP substrate, as well as the fast ion diffusion in the interface of AC and electrolyte. The relationship graphic about calculated area specific capacitance and scan rate is plotted in Figure S1b, apparently, the capacitance decreases with the increase of scan rate. The calculated area specific capacitance is respectively 404, 376, 330, 292 and 233 mF/cm^2 at scan rate of 5, 10, 20, 50 and 100 mV/s. In order to further evaluate the energy storage properties of Ni/AC-FP electrode, GCD test was performed at different current densities of 1-20 mA/cm^2 under the potential window of -0.8-0V, as shown in Figure S1c, the symmetrical triangle-like curves reveal the typical characteristics of EDLC once again. The larger discharge time is 356 s at current density of 1 mA/cm^2, and even at a high current density of 20 mA/cm^2, the discharge time can reach up to 15 s, revealing the well energy storage capability of Ni/AC-FP electrode. The area specific capacitance calculated from GCD curves as function of current density are shown in Figure S1d, encouragingly, the capacitance value does not decrease sharply with the increase of current density, it shows excellent area specific capacitance of 874 mF/cm^2 at 1 mA/cm^2 and achieves 88.7% retention of capacitance when charge-discharge current density increases by 20 times, reflecting the superior rate capability of as-prepared Ni/AC-FP electrode.

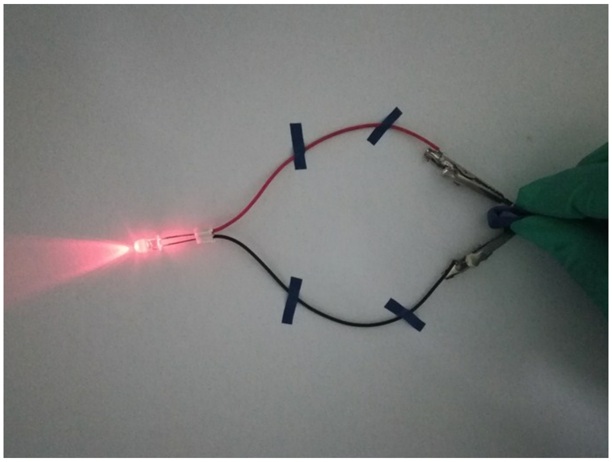

Figure S2. The digital picture of a red lighted LED indicator powered by one bended supercapacitoor.

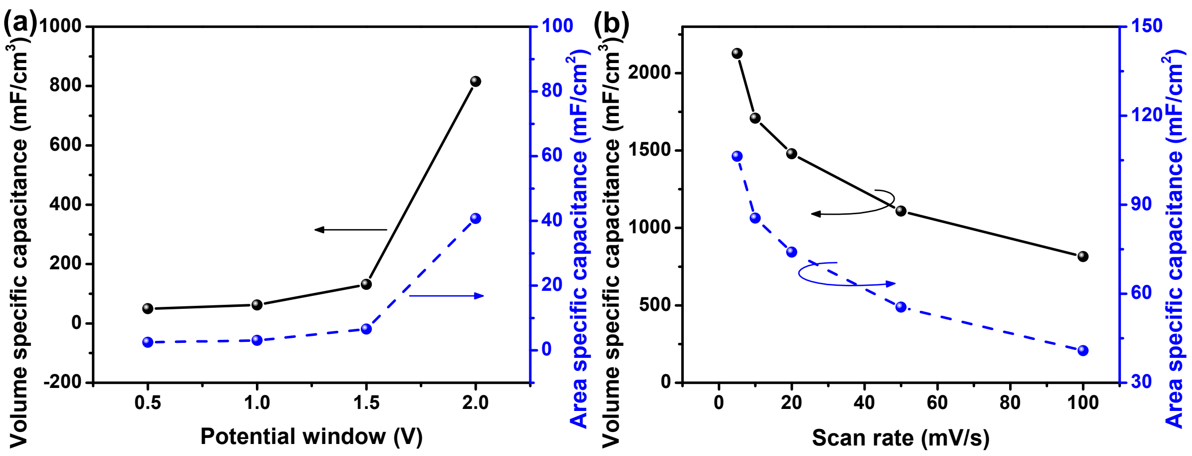

Figure S3. (a) Volume and area specific capacitance of supercapacitor in different potential windows calculated from CV curves at 100 mV/s; (b) Volume and area specific capacitance of supercapacitor calculated from CV curves at different scan rates.

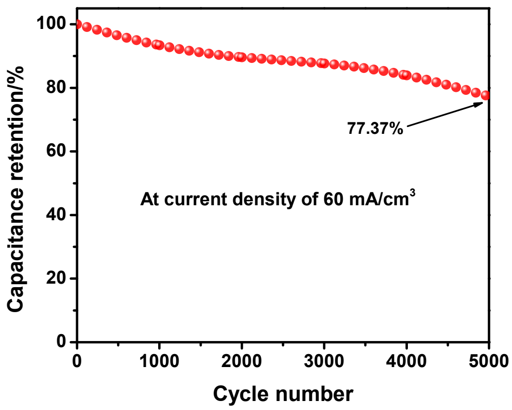

Figure S4. Capacitance retention of Ni/Co(OH)$_2$-FP//Ni/AC-FP supercapacitor as a function of 5000 cycles.

Table S1. Comparison of electrochemical performance of flexible supercapacitor devices.

Electrode		Electrochemical performance (device)			
Positive	Negative	Volume capacitance/ $F \cdot cm^{-3}$	Maximum Energy density/ $mWh \cdot cm^{-3}$	Maximum Power density/ $mW \cdot cm^{-3}$	Reference
$Ni/Co(OH)_2$-FP	Ni/AC-FP	2.13 at 5 $mV \cdot s^{-1}$	0.64	60	Our work
MnO_2/NCAs	AC/Al foil	------------	2.70	3.50	11
Graphite/Ni/ Co_2NiO_4-CP	Graphite/Ni/ AC-CP	7.6 at 5 $mV \cdot s^{-1}$	2.48	790	33
$Ni(OH)_2$/NGP	Mn_3O_4/NGP	3.50 at 10 $mV \cdot s^{-1}$	0.35	32.5	36
ZnO@ZnO-doped MnO_2	ZnO@ZnO-doped MnO_2	0.325 at 0.5 $mA \cdot cm^{-3}$	0.04	2.44	37
Graphite/PANI	Graphite/PANI	3.55 at 4.57 $mA \cdot cm^{-3}$	0.32	54	38
GaN/GP	GaN/GP	------------	0.3	1000	39
PPy@CNTs@UY	PPy@CNTs@UY	5.1 at 5 $mV \cdot s^{-1}$	0.47	10.18	40
MnO_2/ZnO	HI-rGO	0.52 at 10 $mV \cdot s^{-1}$	0.234	133	41
TiN/carbon cloth	TiN/carbon cloth	0.33 at 2.5 $mA \cdot cm^{-3}$	0.05	300	42
MVNN/CNTs	MVNN/CNTs	7.9 at 25 $mA \cdot cm^{-3}$	0.54	430	43