Supporting Information for

$NiCo_2O_4$@Polyaniline Nanotubes Heterostructure Anchored on Carbon Textiles with Enhanced Electrochemical Performance for Supercapacitor Application

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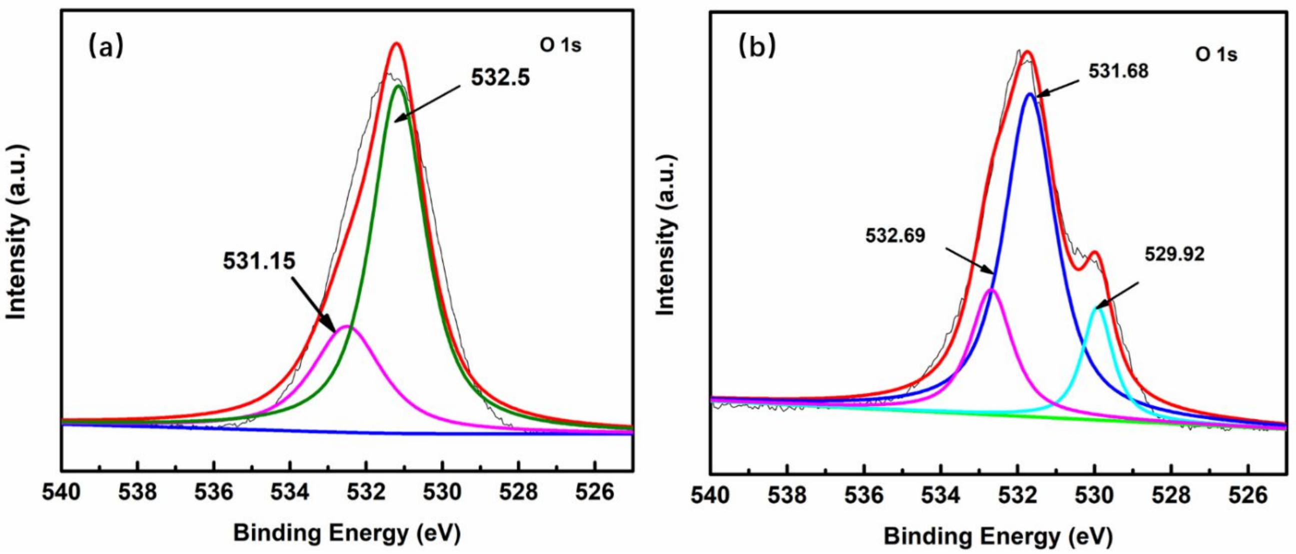

Figure S1. XPS spectra of O 1s for the $NiCo_2O_4$@PANI(a) and $NiCo_2O_4$ (b).

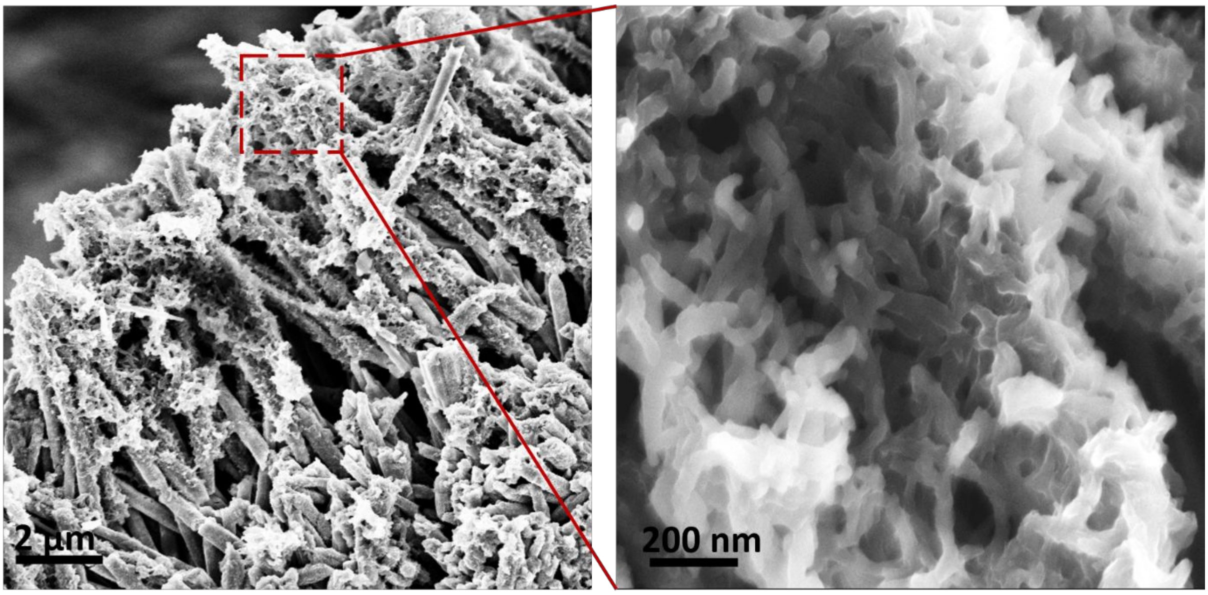

Figure S2. SEM images of the PANI nanofiber network on the surface of the $NiCo_2O_4$ nanotube.

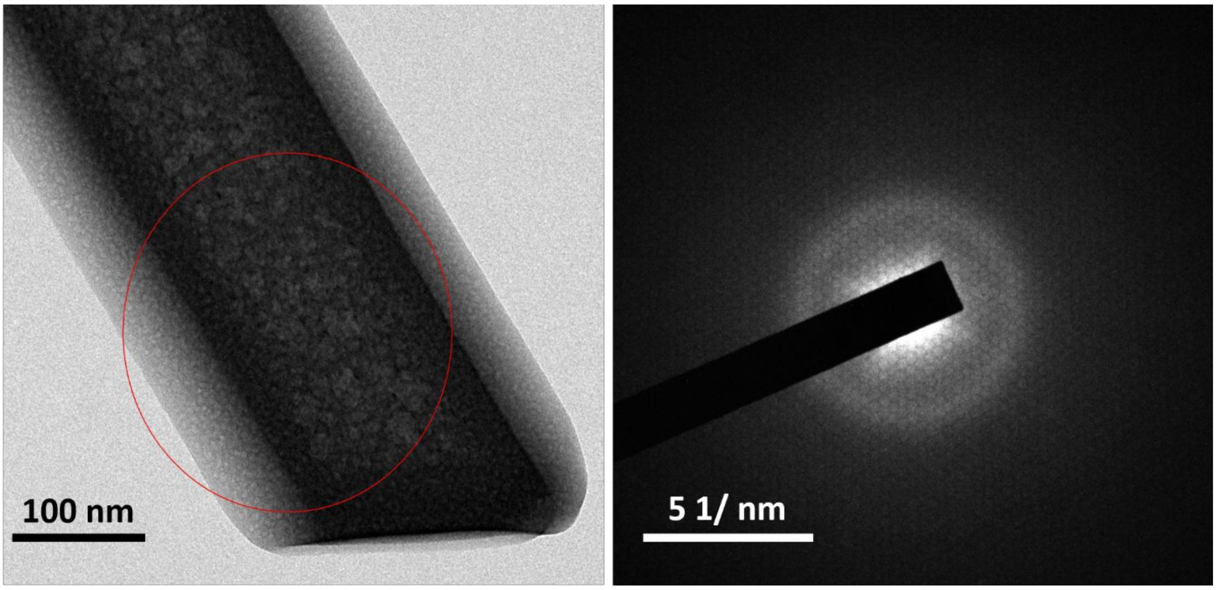

Figure S3. HRTEM images and corresponding FFT pattern of PANI membrane on the surface of nanotubes

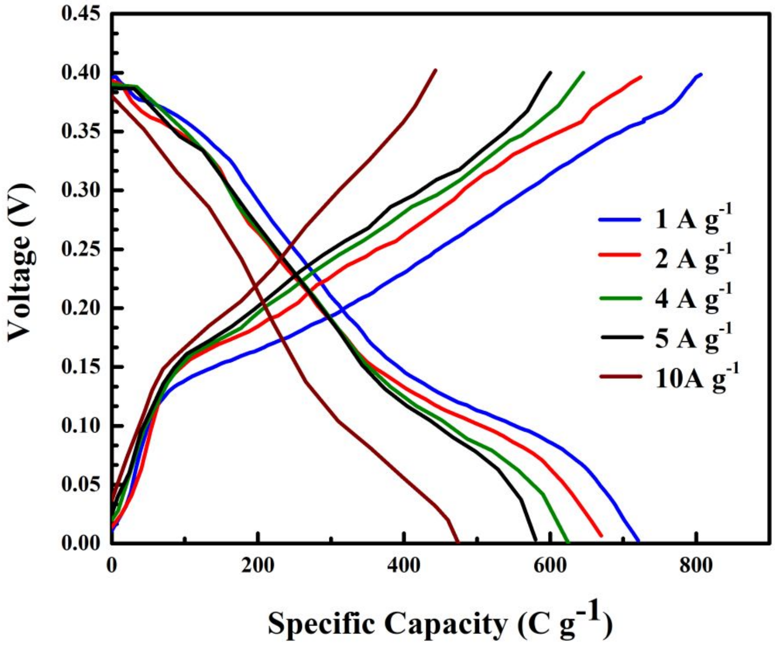

Figure S4. Voltage/Capacity curves of $NiCo_2O_4$@PANI at different current densities.

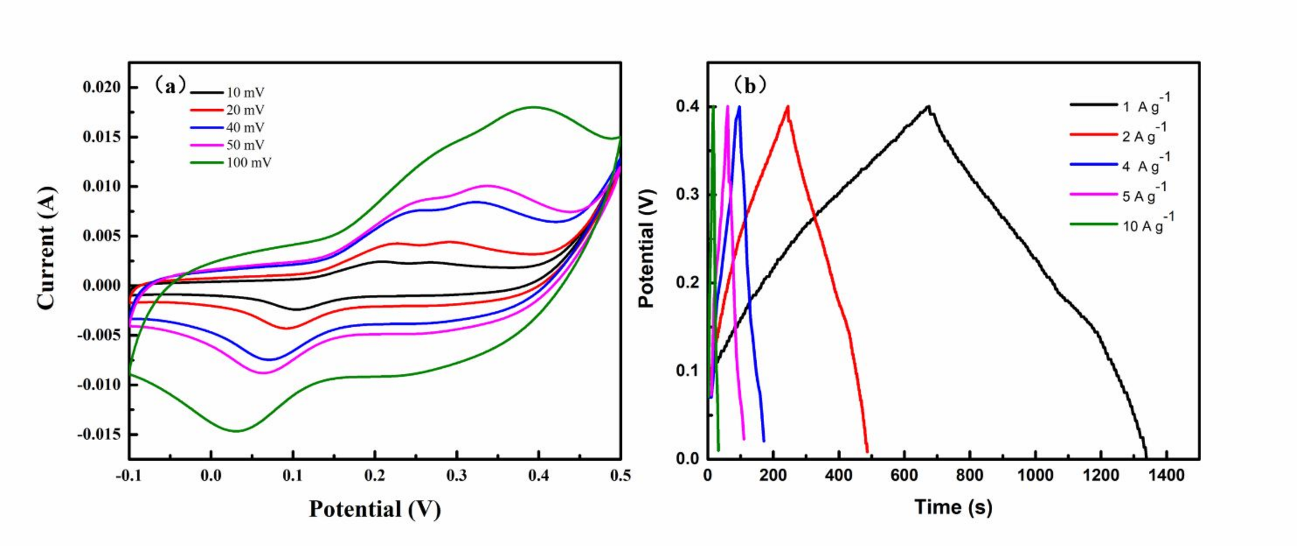

Figure S5. CV curves from 5 to 100 mVs^{-1} and GCD curves at various current density of $NiCo_2O_4$ sample.

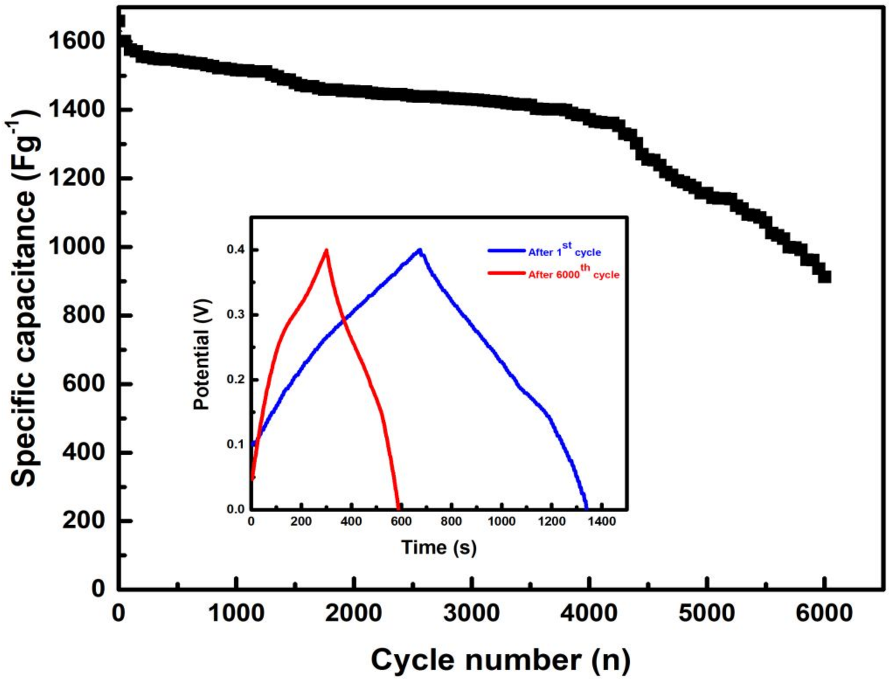

Figure S6. cycling performance at current densities of 1 A g^{-1} of $NiCo_2O_4$ sample after 6000 cycles.

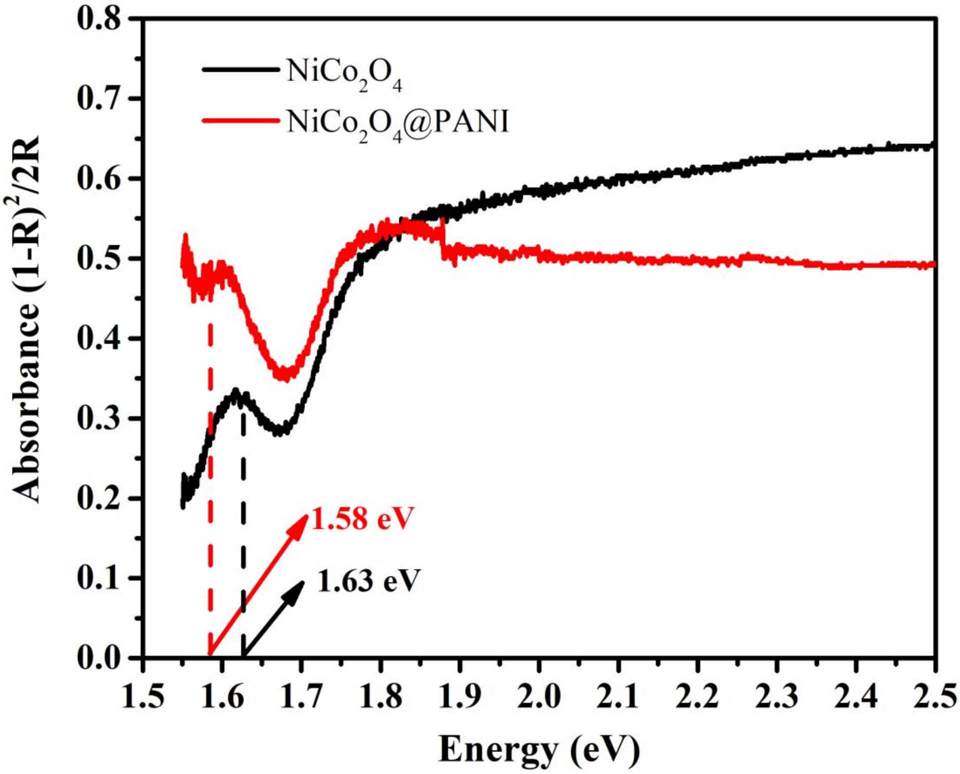

Figure S7. Kubelka-Munk transformed diffuse reflectance spectrum of $NiCo_2O_4$ and $NiCo_2O_4$@PANI samples

Dunn Method Analysis:

According to Dunn et al.[1],we have analyzed cyclic voltammetry experiment data at different scan rates for $NiCo_2O_4$@PANI and $NiCo_2O_4$ to study the different energy storage mechanisms. Because the charge storage processes can be separated to capacitive and diffusion-controlled contribution, it can be distinguished by fitting the relation between the peak current(i) and the scan rate(v) to the Eq.S1,

$$\mathrm{i} = \mathrm{a}v^{b} \qquad \text{Eq. S1}$$

where a and b are constants for certain electrochemical processes and b values(0.5~1) indicates the mechanism. When b coming to 0.5 indicts the diffusion-controlled behavior, while it approaching to 1 implies surface-controlled pseudocapacitive process.

To have a further insight on the mechanisms at play during the whole voltammetry curve, we can use the concepts mentioned above to deconvolute the two components corresponding two limiting situation and express the total current response at a certain potential as being the sum of two separate mechanisms, surface capacitive effects and diffusion-controlled insertion processes[2]:

$$\mathrm{i(V)} = k_1 v + k_2 v^{1/2} \qquad \text{Eq.S2}$$

where $i(V)$ is the total current at the fixed potential V among the potential window, $k_1 v$ stands for surface capacitive process showing a linear dependence of the scan rate, while pure diffusion-controlled faradaic processes will show a linear dependence of the square root of the scan rate. Thus, the percentage of pseudocapacitive contribution is quantitatively determined by obtaining k_1 and k_2 values.

Table S1. Comparison of the Electrochemical Performance of the $NiCo_2O_4$@PANI Electrode with that of Previously Reported Electrodes

Material	Surface morphology	Capacitance	Current density	Electrolyte	Cycling performance	Reference
$Ni_{0.67}Co_{0.33}MoO_4$	rod-like	441 C g^{-1}	1 A g^{-1}	6 M KOH	76.2 % after 1000 cycles	3
Co_3O_4@$NiCo_2O_4$	nanowires	9.12 F cm^{-2}	2mAcm^{-2}	2 M KOH		4
rGO/ $NiCo_2O_4$	nanowires	1248 F g^{-1}	2mAcm^{-2}		90% over 2000 cycles	5
$NiCo_2O_4$	nanowire arrays	1642 F g^{-1}	1 A g^{-1}	6 M KOH	95.7% after 10000 cycles	6
Ppy@ $NiCo_2S_4$	core-shell heterostructure	908.1 F g^{-1}	1 A g^{-1}	2 M KOH	87.7% after 2000 cycles	7
carbon spheres/ $NiCo_2O_4$	spheres	920 F g^{-1}	1 A g^{-1}	6 M KOH	87.9% after 2000 cycles	8
Co_3O_4	nanoflakes	576.8 C g^{-1}	1 A g^{-1}	2 M KOH	82% after 5000 cycles	9

$NiCo_{2-x}Fe_xO_4$	Nanotubes	2057 F g^{-1}	1 A g^{-1}	6 M KOH	90.32% after 3000 cycles	10
Carbon fibers/ $NiCo_2O_4$	Nanosheet	1221 F g^{-1}	1 A g^{-1}	2 M KOH	81% after 3000 cycles	11
Co_3O_4@PPy	Nanorod arrays	1.02 F cm^{-2}	1.5 mA cm^{-2}	6 M KOH	10,000 cycles	12
$NiCo_2O_4$@PANI	Nanotube arrays	720.5 C g^{-1}	1 A g^{-1}	6 M KOH	99.64% after 10000 cycles	This work

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