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# Flexible, Sandwich-Like CNTs/$NiCo_2O_4$ Hybrid Paper Electrodes for All-Solid State Supercapacitors

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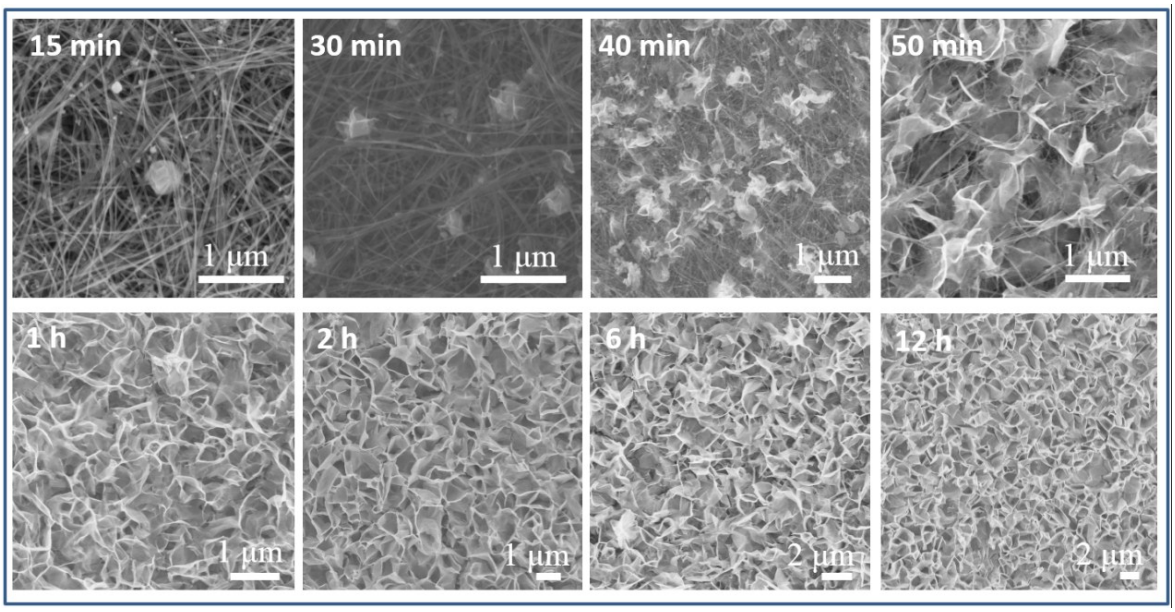


**Figure S1.** SEM images of CNTs/$NiCo_2O_4$ hybrid paper synthesized with different solvothermal time.

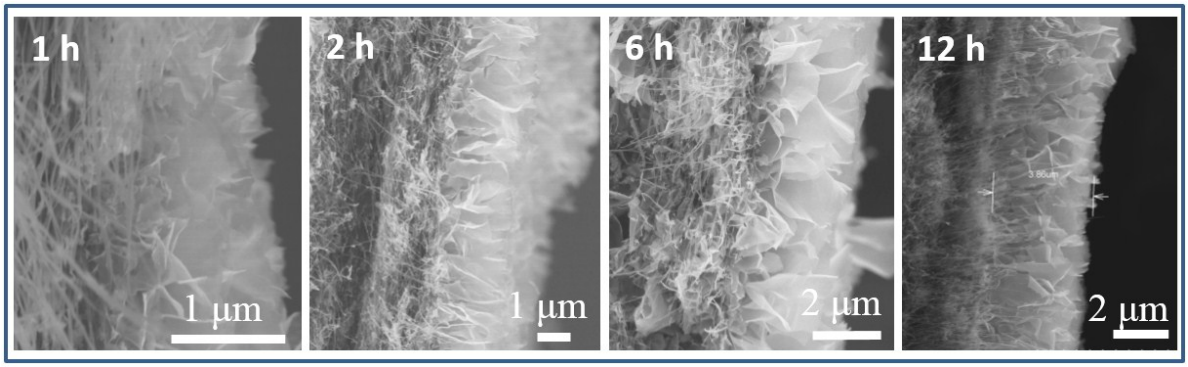


**Figure S2.** Cross-sectional SEM images of CNTs/$NiCo_2O_4$ hybrid paper synthesized with different solvothermal time.

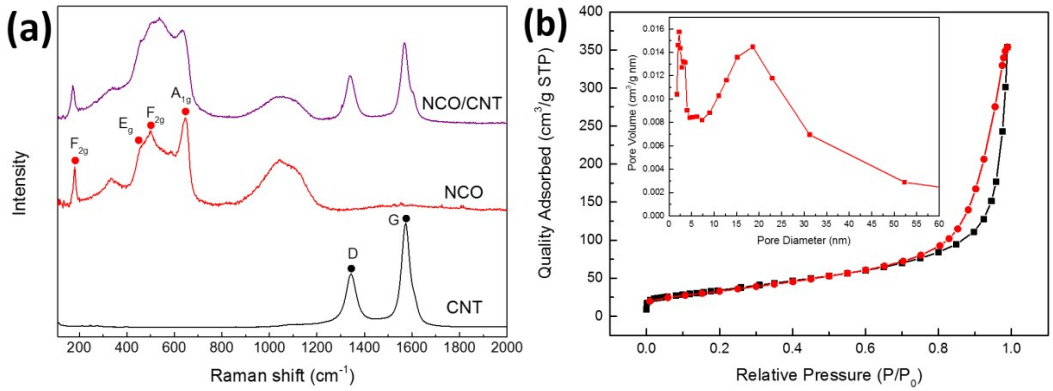


**Figure S3.** (a) Raman spectra of $NiCo_2O_4$ (NCO), CNT buckypaper (CNT) and CNTs/$NiCo_2O_4$ (CNT/NCO) hybrid paper. (b) $N_2$ adoption and desorption isotherms of the CNTs/$NiCo_2O_4$ sample synthesized with the solvothemal time of 2 hours; the inset is the pore size distributions of the sample.

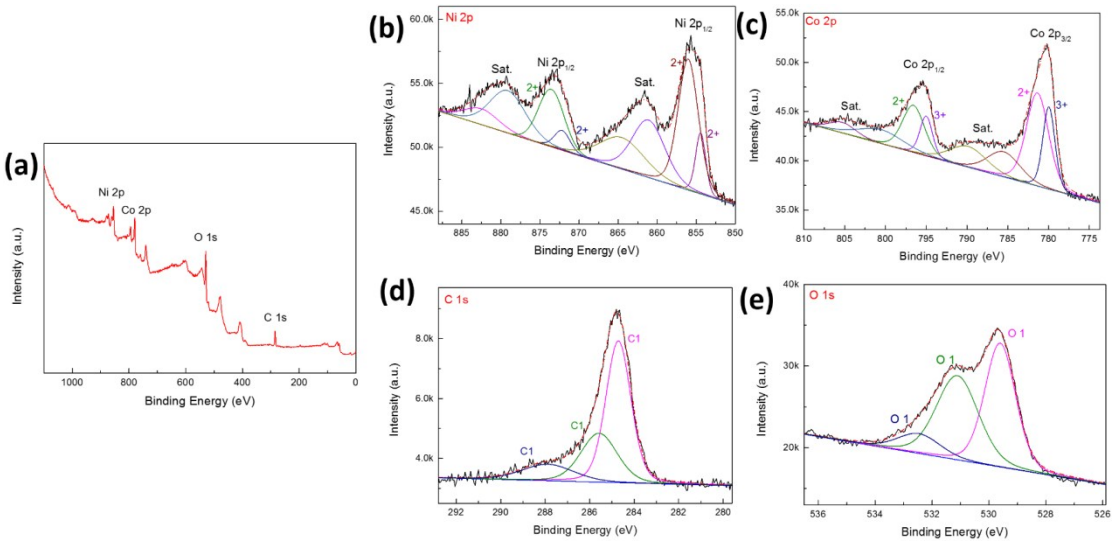


**Figure S4.** (a) XPS spectrum of CNTs/$NiCo_2O_4$ showing the signals for Ni, Co, O and C elements. (b) Core level spectra of the Ni 2p region. (c) Core level spectra of the Co 2p region. (d) Core level spectra of the C 1s region. (e) Core level spectra of the O 1s region.

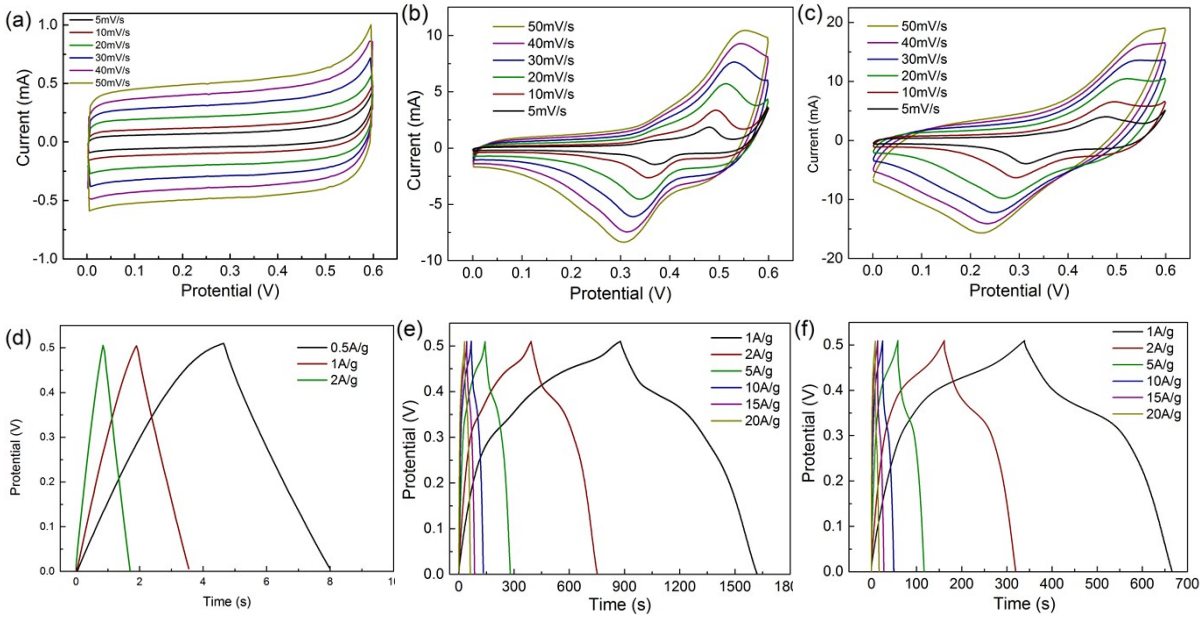


**Figure S5.** (a) and (d) CNTs buckypaper characterized by CV curves at scan rates varying from 5 to 50 mV/s and GCD curves at different current densities from 0.5 to 2 A/g. (b) and (e) The CNT/NCO-1h electrode characterized by CV curves at scan rates varying from 5 to 50 mV/s and GCD curves at different current densities varying from 1 to 20 A/g. (c) and (f) The CNT/NCO-6h electrode characterized by CV curves at scan rates varying from 5 to 50 mV/s and GCD curves at different current densities varying from 1 to 20 A/g.

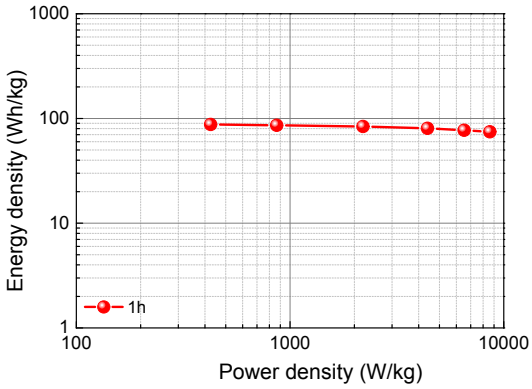


**Figure S6.** Ragone plot of CNT/NCO-1h hybrid paper electrode.

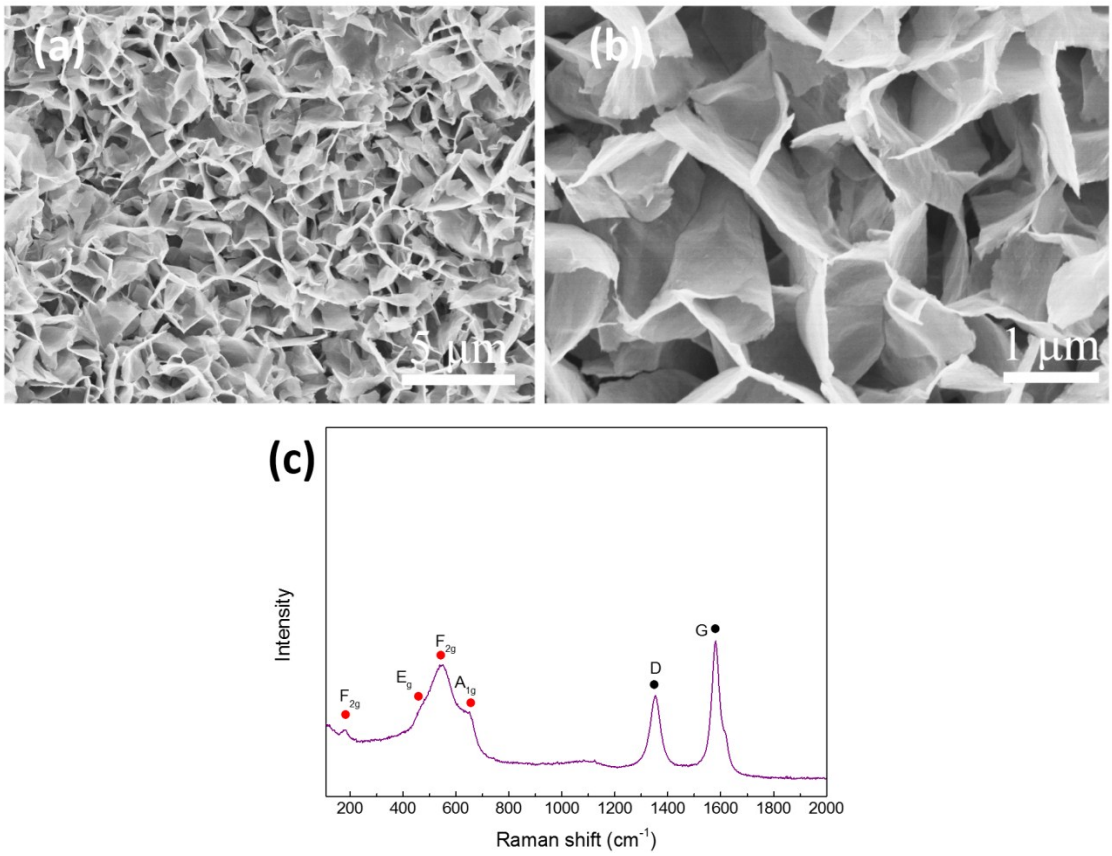


**Figure S7.** (a) and (b) SEM images, and (c) Raman spectrum of the CNT/NCO-2h electrode after 4000 cycles of CV scans.

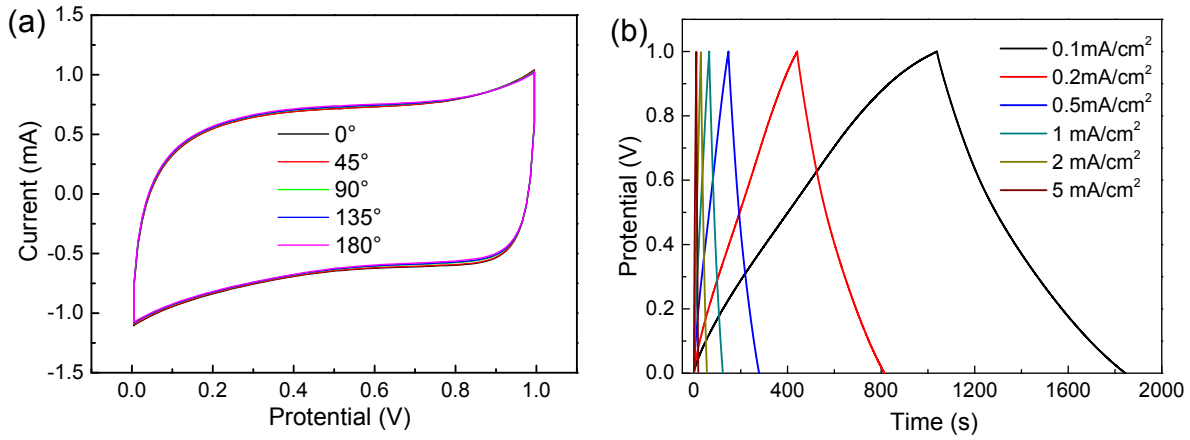


**Figure S8.** Electrochemical performance of all-solid-state supercapacitors assembled with the CNT/NCO-1h electrodes. (a) CV curves of the supercapacitors at a scan rate of 50 mV/s under bending at various angles. (b) Galvanostatic charge/discharge curves of the supercapacitors at different current densities.

**Table S1** Comparison of the electrochemical performance of the $NiCo_2O_4$ based electrodes.

| No. | Electrode materials | Preparation method | Specific capacitance (F/g) | Rate performance | Capacity retention |
|---|---|---|---|---|---|
| [1] | $NiCo_2O_4$@$NiCo_2O_4$ core/shell | Solvothermal and chemical deposition | 900 (1 A/g) | 75% (20 A/g) | 98.6% (4000 cycles) |
| [2] | $NiCo_2O_4$-RGO | Self-assembly and thermal treatment | 835 (1 A/g) | 74% (16 A/g) | 85.7% (4000 clcles) |
| [3] | Ni@$NiCo_2O_4$ nanosheets | Solvothermal and thermal treatment | 899 (1 A/g) | 70.9% (10 A/g) | 84.9% (6000 cycles) |
| [4] | Double-shelled $Co_3O_4$/$NiCo_2O_4$ | Template method and thermal treatment | 972 (5 A/g) | 89.5% (10 A/g) | 92.5% (12000 cycles) |
| [5] | $NiCo_2O_4$ nanorod/CF | Solvothermal and thermal treatment | 1023.6 (1 A/g) | 61.5% (10 A/g) | 91.5% (2400 cycles) |
| [6] | $NiCo_2O_4$ nanosheets | Solvothermal and thermal treatment | 1388 (2 A/g) | 85% (10 A/g) | 89.4% (12000 cycles) |
| [7] | $NiCo_2O_4$ nanosheets/Ni foam | Solvothermal and thermal treatment | 1743 (8.5 mA/cm$^2$) | 61.1% (25 mA/cm$^2$) | 93.2% (3000 cycles) |
| [8] | $NiCo_2O_4$ nanosheets/Ni foam | Co-electrodeposition and thermal treatment | 2010 (2 A/g) | 79.4% (12 A/g) | 94% (2300 cycles) |
| Our work | $NiCo_2O_4$ nanosheets/CNT | Solvothermal and thermal treatment | 1752.3 (1 A/g) | 92% (10 A/g) | 95.6% (7000 cycles) |

## References:


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