Electronic Supplementary Material

Construction of $NiCo_2O_4$ nanoflake arrays on cellulose-derived carbon nanofibers as a freestanding electrode for high-performance supercapacitors

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Materials

All the materials were used as received in this work. The α-Cellulose (partical size ~25 μm), polyethylene oxide (PEO), trifluoroacetic acid (TFA), nickel nitrate hexahydrate ($Ni(NO_3)_2•6H_2O$), cobaltous nitrate hexahydrate ($Co(NO_3)_2•6H_2O$), hexamethylenetetramine (HMTA) and polyvinyl alcohol (PVA, 1788) were purchased from Shanghai Macklin Biochemical Technology Co., Ltd. Potassium hydroxide (KOH) was received from Sinopharm Chemical Reagent Co., Ltd. Dichloromethane (DCM) was purchased from Shanghai Lingfeng Chemical Reagent Co., Ltd. Methanol was obtained from Yonghua Chemical Technology (Jiangsu) Co., Ltd. The poly(acrylonitrile-*co*-methylhydrogen itaconate) [P(AN-*co*-MHI)] copolymer was synthesized in our previous work [1], which was used as precursor to prepare carbon nanofibers.

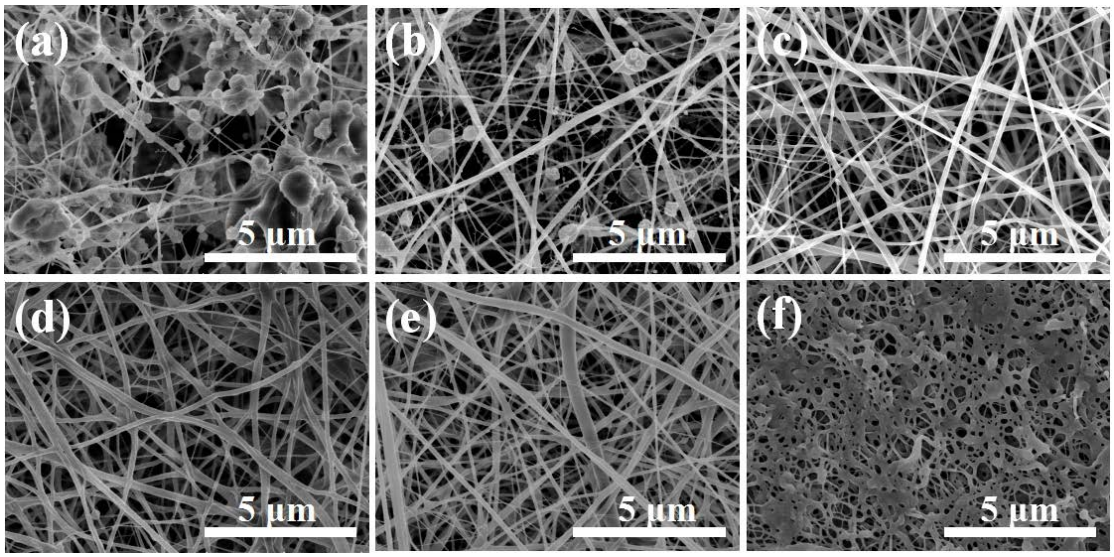

Fig. S1. SEM images of C-NFs prepared at different spinning concentrations (a) 3.5 wt%; (b) 4.5 wt%; (c) 5.5 wt%; (d) 6 wt%; (e) 6.5 wt %;(f) 7 wt%.

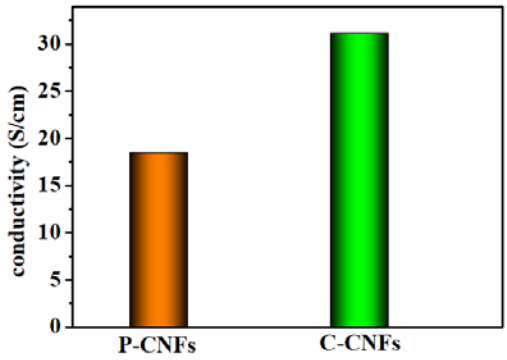

Fig. S2. The conductivity of C-CNFs and P-CNFs at 1600℃.

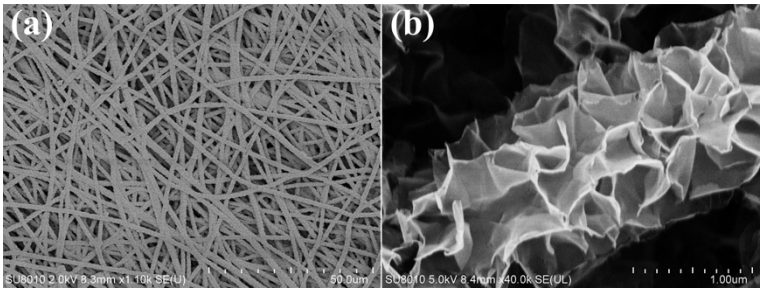

Fig. S3. SEM images of P-CNFs/$NiCo_2O_4$ electrode materials after calcination.

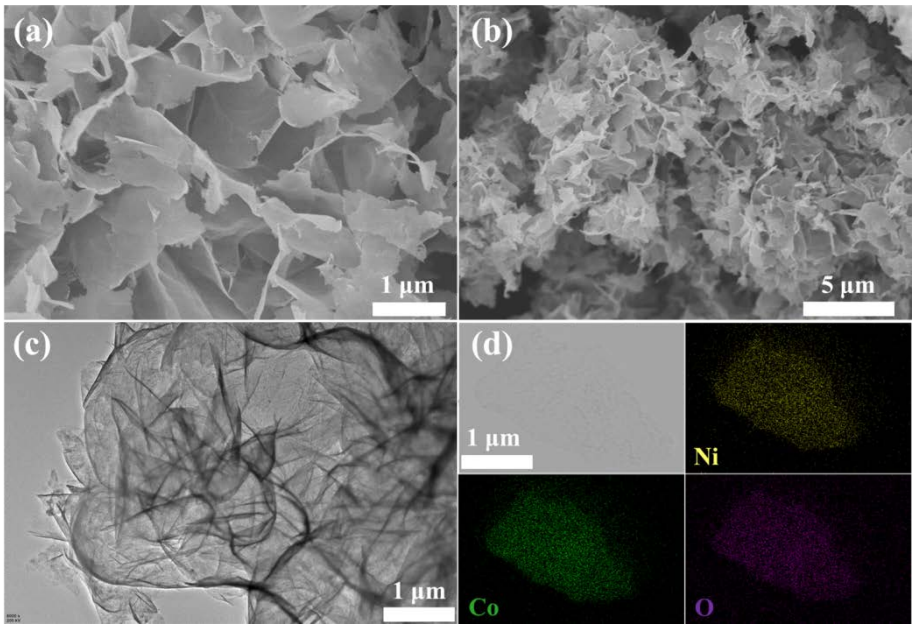

Fig. S4. SEM images (a-b), TEM images (c) and elemental mapping for Ni, Co and O (d) of bare $NiCo_2O_4$.

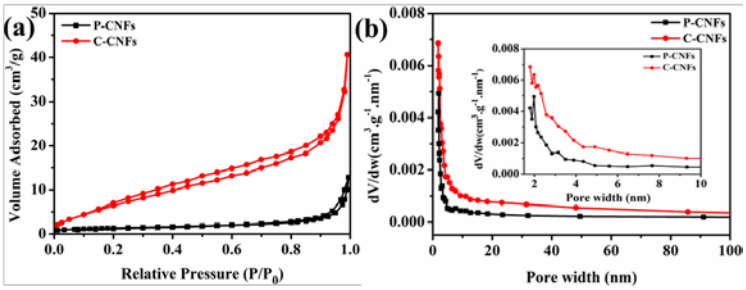

Fig. S5. N_2 adsorption-desorption isotherms (a) and pore size distribution curves (b and inset) of P-CNFs and C-CNFs.

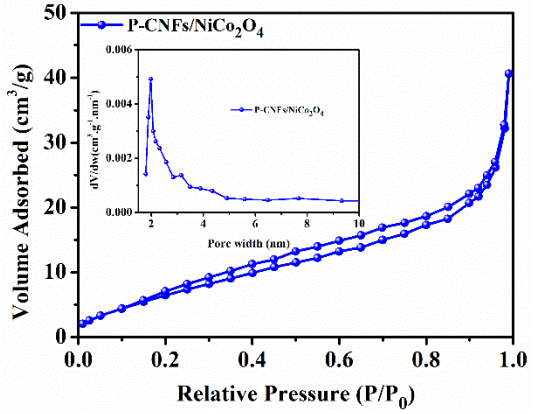

Fig. S6. N_2 adsorption-desorption isotherms and pore size distribution curves (inset) of P-CNFs/$NiCo_2O_4$ nanoflake arrays.

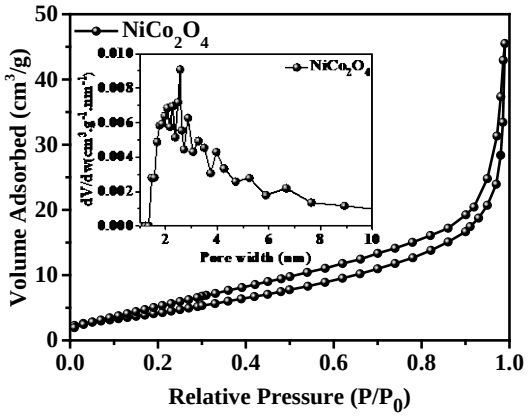

Fig. S7. The N_2 adsorption-desorption isotherms and pore size distribution curves of bare $NiCo_2O_4$.

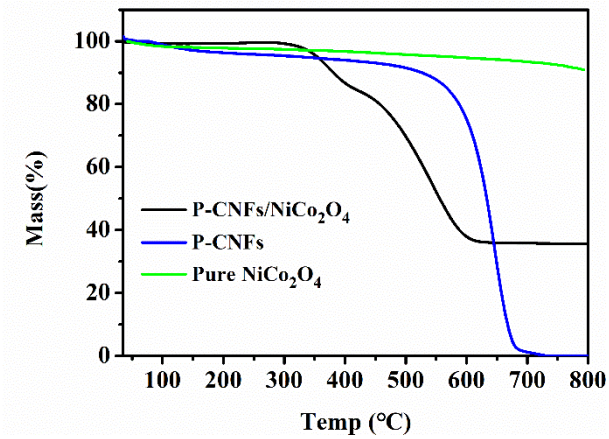

Fig. S8. TG patterns of P-CNFs/$NiCo_2O_4$ nanoflake arrays, P-CNFs and pure $NiCo_2O_4$.

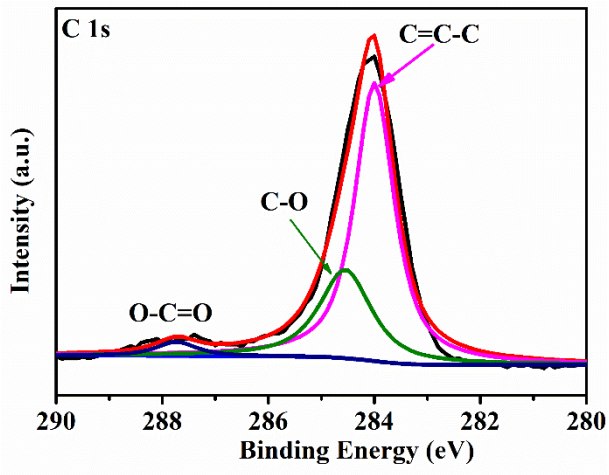

Fig. S9. High-resolution XPS spectra for C 1s.

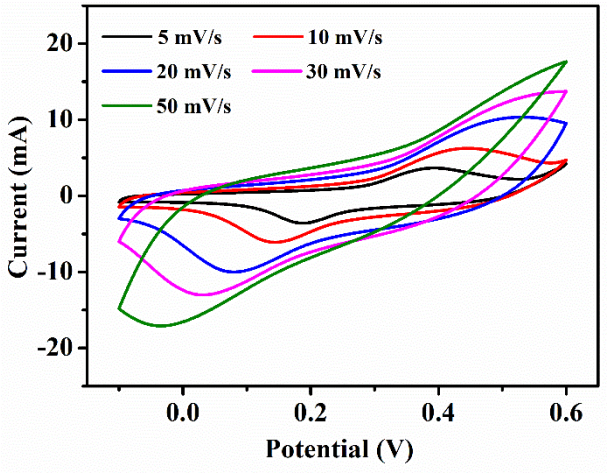

Fig. S10. CV curves of P-CNFs/$NiCo_2O_4$ nanoflake arrays at different scan rates.

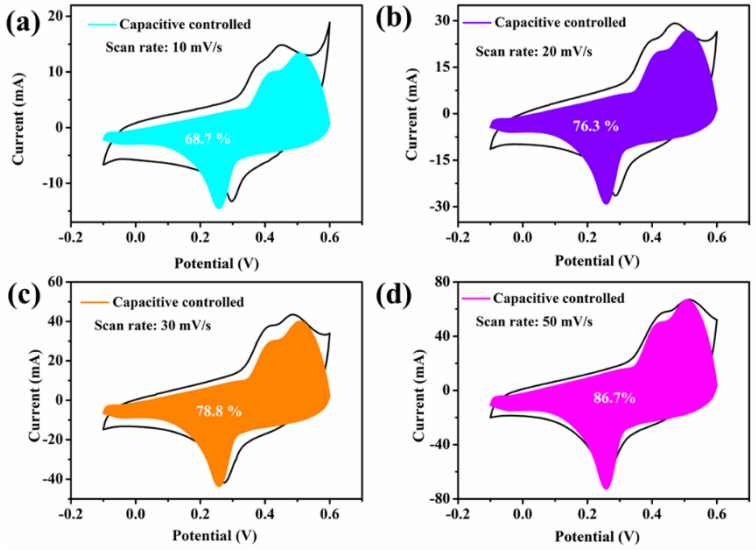

Fig. S11. The capacitive controlled contribution of C-CNFs/$NiCo_2O_4$ nanoflake arrays at different scan rates.

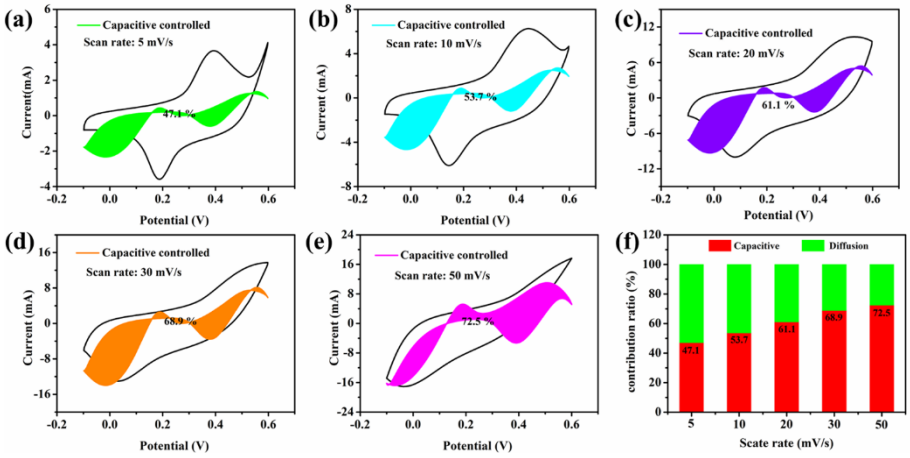

Fig. S12. The capacitive controlled contribution and contribution comparison of P-CNFs/$NiCo_2O_4$ nanoflake arrays at different scan rates.

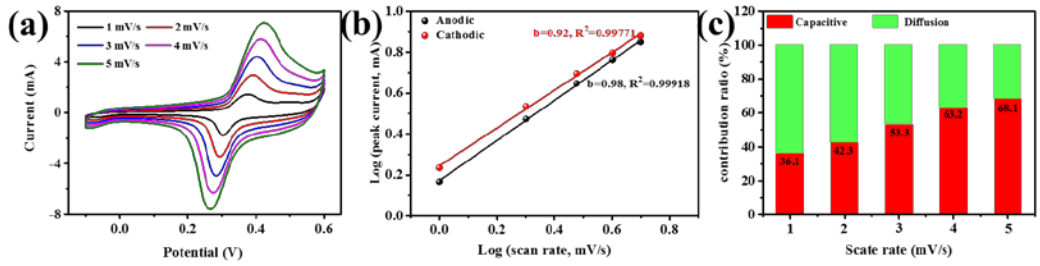

Fig. S13. (a) The CV curves at various scan rates ranging from 1 mV/s to 5 mV/s and (b) logarithm relationship between anodic/ cathodic peaks current and scan rate of C-CNFs/$NiCo_2O_4$ nanoflake arrays; (c) the contribution comparison at different scan rates of C-CNFs/$NiCo_2O_4$ nanoflake arrays.

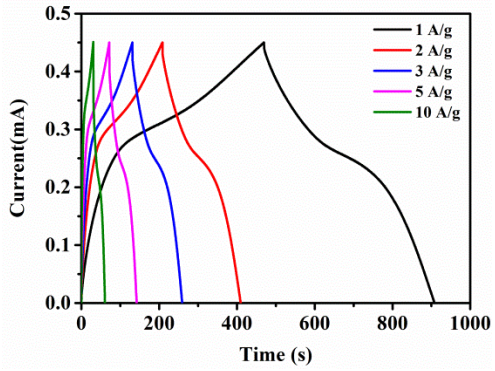

Fig. S14. Galvanostatic charge-discharge curves of P-CNFs/$NiCo_2O_4$ nanoflake arrays at different current densities.

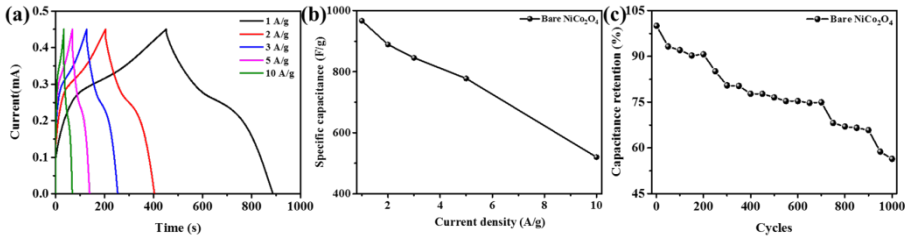

Fig. S15. The GCD curves (a), specific capacitance (b) at various current densities and long-cycling performances at 10 A/g (c) of bare $NiCo_2O_4$.

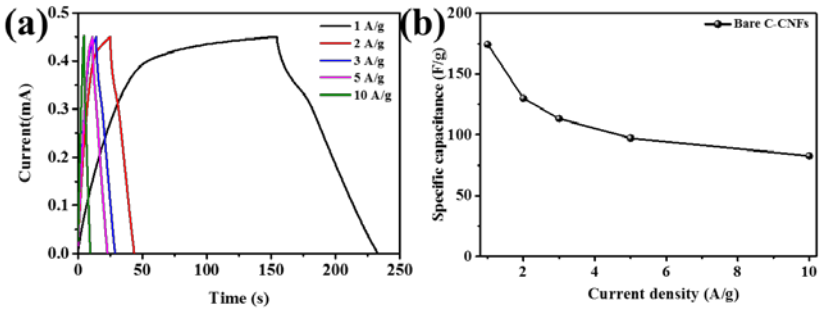

Fig. S16. The GCD curves (a), specific capacitance (b) at various current densities of bare C-CNFs.

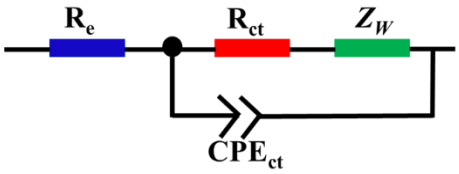

Fig. S17. The equivalent circuit of C-CNFs/$NiCo_2O_4$ and P-CNFs/$NiCo_2O_4$ nanoflake arrays.

Table S1 The carbon content of C-CNFs with different temperature.

Temperature (℃)	**C (%)**	**H (%)**	**N (%)**
800	88.38	1.55	0.05
1200	90.74	0.59	0.75
1600	98.76	0.36	0.16

[1] A. Ju, S. Guang, H. Xu, Effect of comonomer structure on the stabilization and spinnability of polyacrylonitrile copolymers, Carbon 54 (2013) 323-335.