P/N/O co-doped carbonaceous materials based supercapacitor with voltage up to 1.9 V in the aqueous electrolyte

Xutang Qing[a], Yi Cao[a], Jing Wang[a], Jingjie Chen[a], Yun Lu[a,*]

a Department of Polymer Science and Engineering, State Key Laboratory of Coordination Chemistry, Key Laboratory of High Performance Polymer Materials and Technology of Ministry of Education, School of Chemistry and Chemical Engineering, Nanjing University, Nanjing 210093, PR China

[*] Corresponding author, Tel: (86)-25-83686423 Fax: (86)-25-83686423

E-mail: yunlu@nju.edu.cn

Experimental

Materials

Aniline, ammonium persulfate (AR grade), hydrochloric acid and 70wt% phytic acid solution were purchased from Sinopharm Chemical Reagent Co., Ltd. Aniline monomer was distilled under reduced pressure. Ammonium persulfate and phytic acid solution were used as received without further treatment.

Calculations

In the three electrode system, the specific capacitance (*C*) is calculated from the galvanostatic discharge curve by the equation $C = \frac{it}{m \times \Delta V}$. where i = discharge current (A), t = discharge time (s), m = mass of the active material (g), ΔV = the potential range (V).

In the two electrode system, the specific capacitance (*C*), energy density (*E*) and power density (*P*) are respectively calculated from the galvanostatic discharge curve by the equations:

$C = \frac{it}{m \times \Delta V}$, where C = specific capacitance (F/g), i = discharge current (A), t = discharge time (s), m = total mass of the active material (g), ΔV = the potential range (1.9 V in this work).

$C_s = 4C$, where C_s = specific capacitance of a single electrode (F/g).

$E = \frac{1}{2} \times C \times (\Delta V)^2$, where E = energy density (J/g).

$P = E / \Delta t$, where P = power density (W/g).

Figures

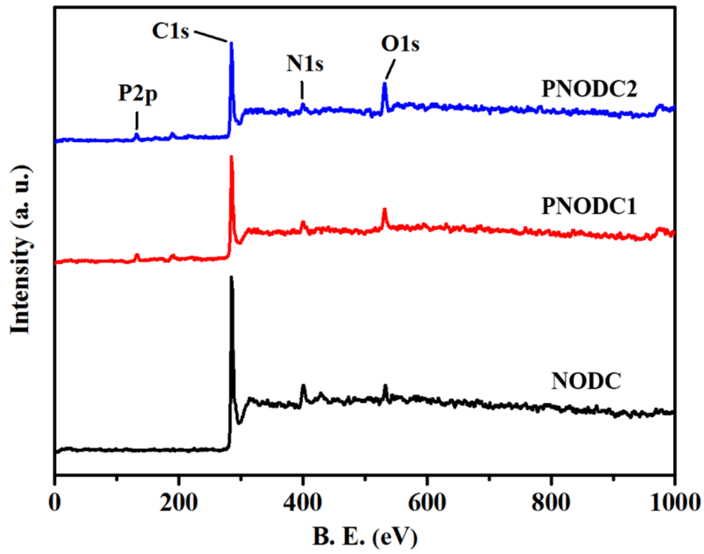

Figure S1. Overall surveys of XPS spectra of all carbon samples.

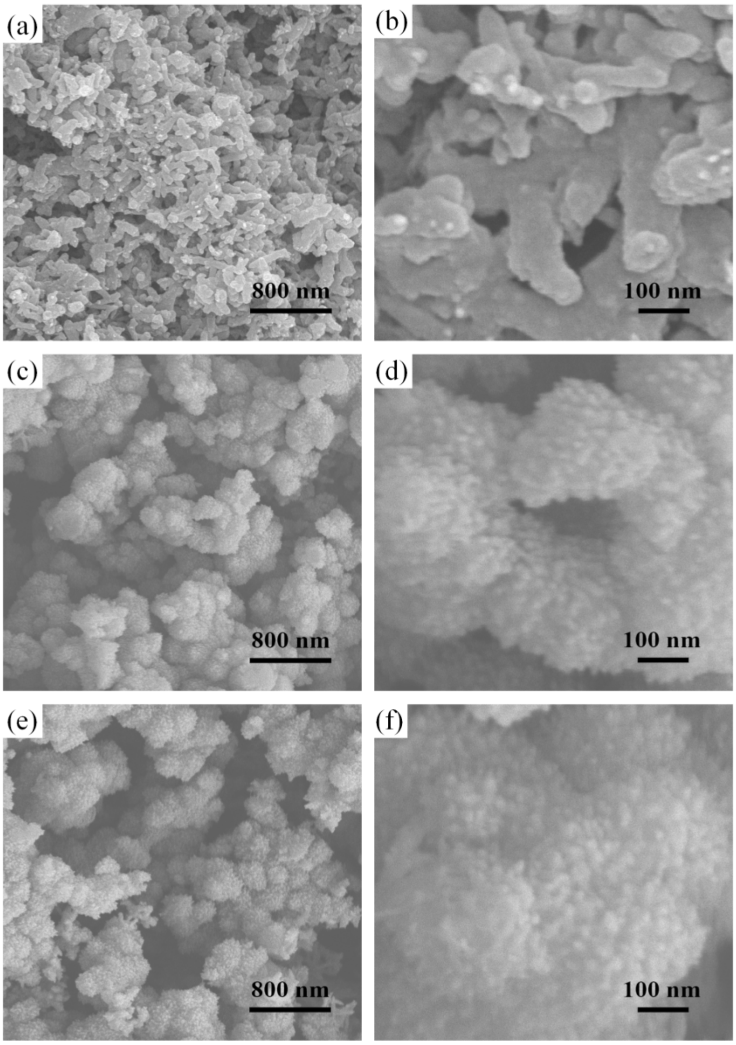

Figure S2. SEM images of (a-b) HCl-PANI, (c-d) PA-PANI1 and (e-f) PA-PANI2.

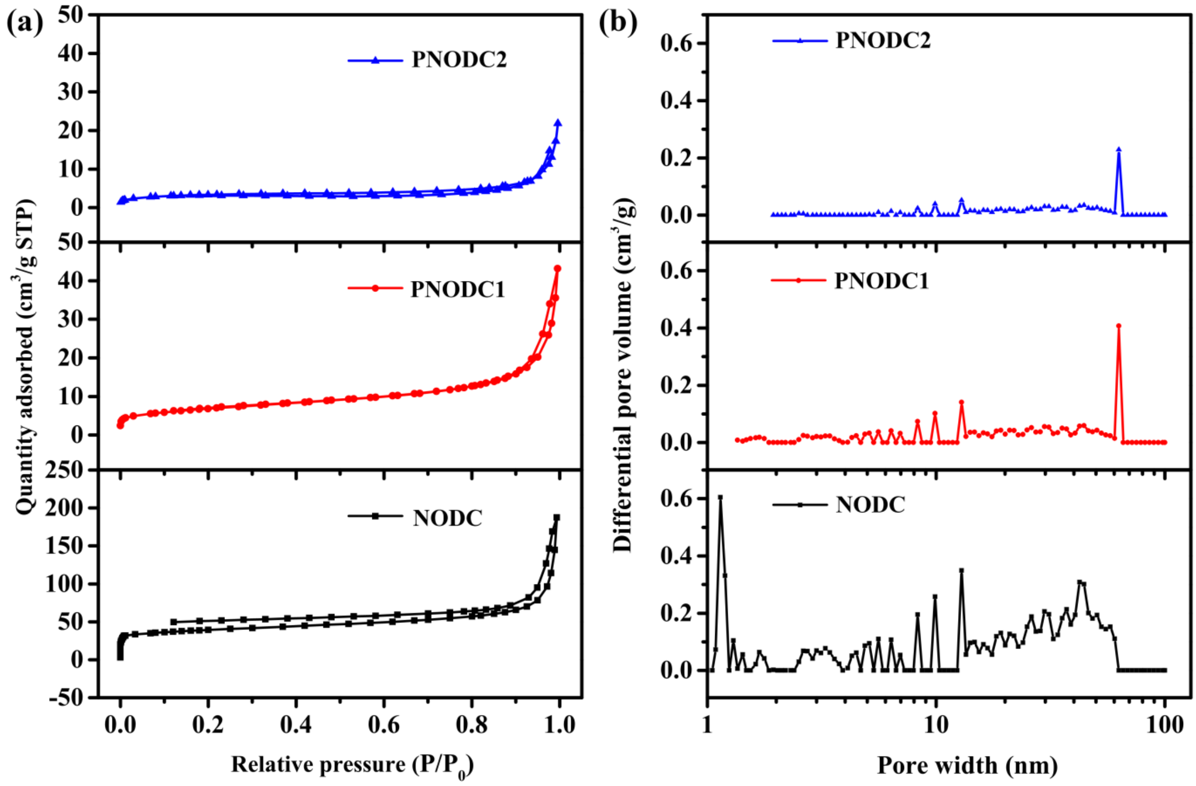

Figure S3. N_2 sorption isotherms and PSD by NLDFT of NODC, PNODC1 and PNODC2.

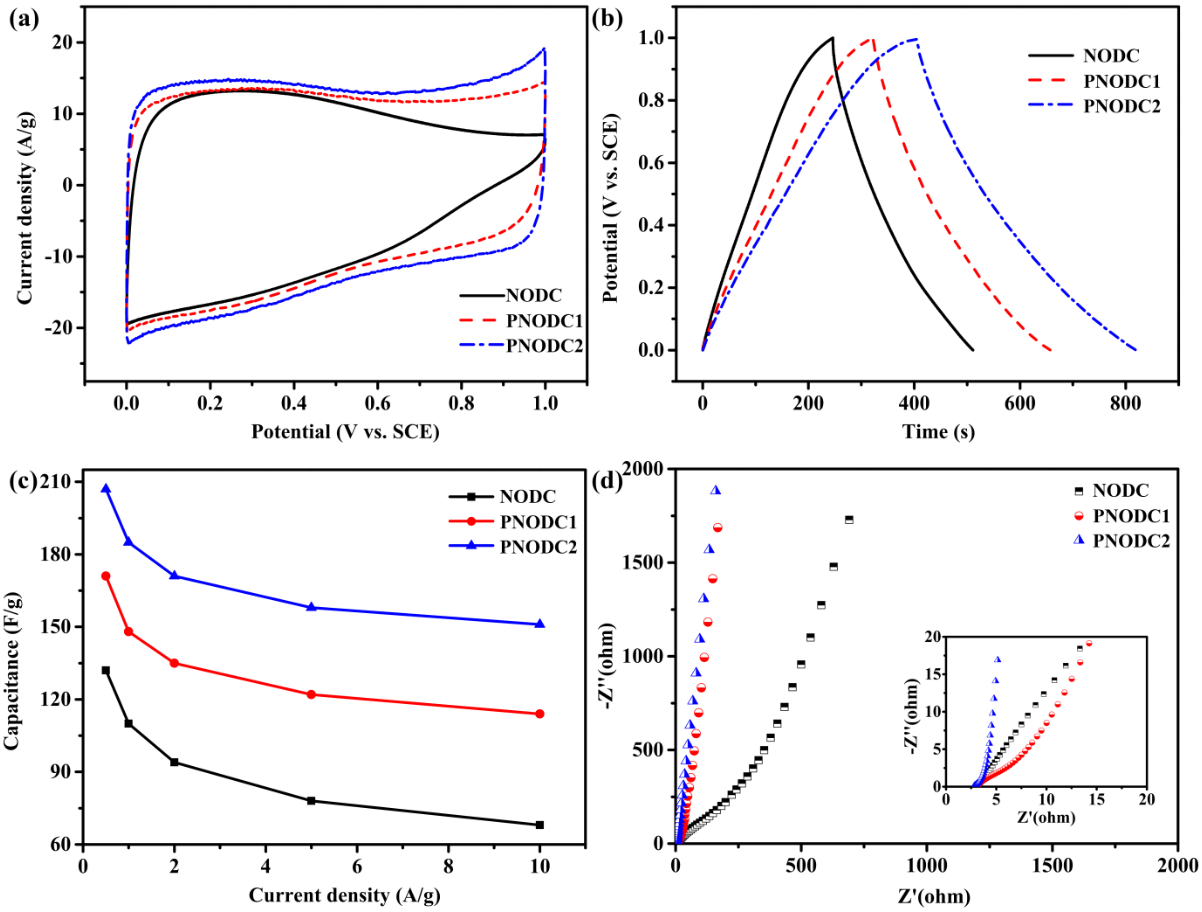

Figure S4. (a) CV curves at 100 mV/s; (b) galvanostatic charge and discharge curves; (c) specific capacitance vs. current density plots from 0.5 A/g to 10 A/g; (d) Nyquist plots, the inset is the magnified view of the high-frequency zone, of all carbon samples in three electrode system in the 1 M H_2SO_4 solution.

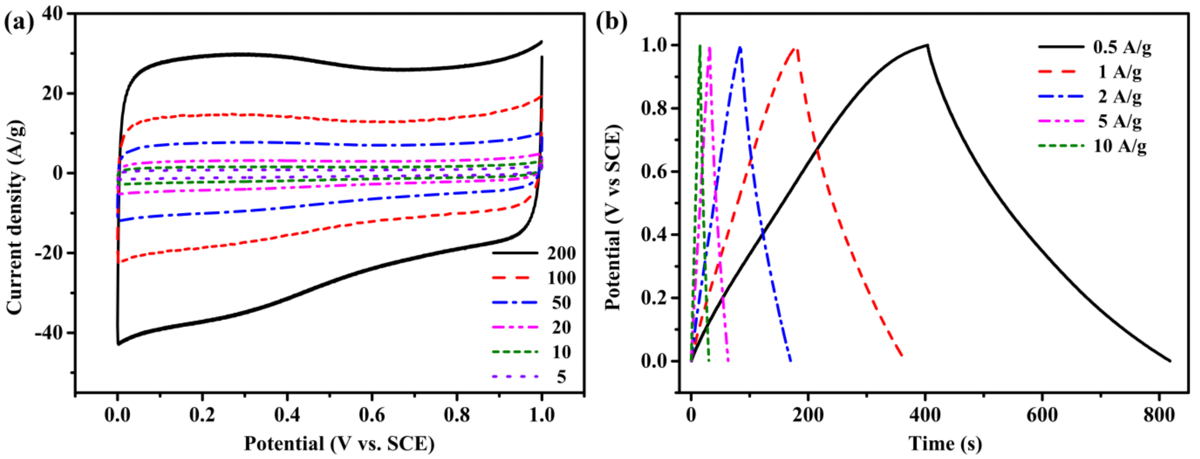

Figure S5. (a) CV from 5 mV/s to 200 mV/s and (b) galvanostatic charge and discharge curve of PNODC2 in three electrode system in 1 M H_2SO_4 electrolyte.

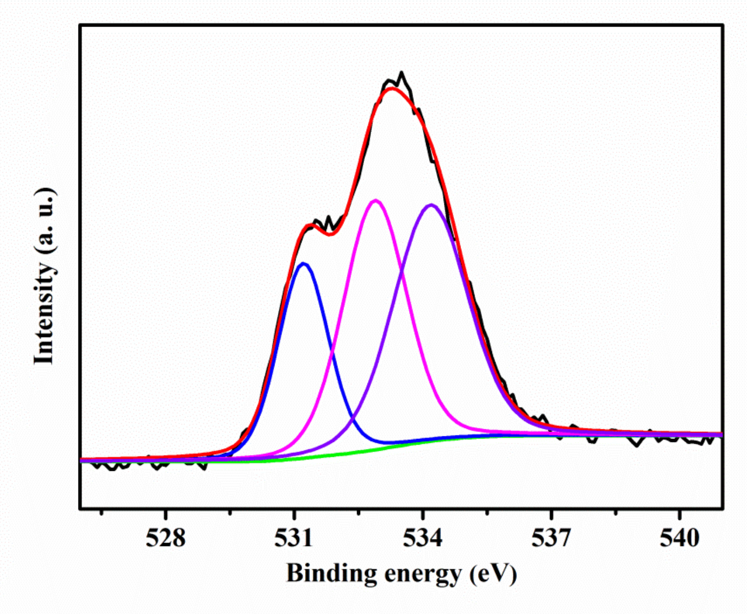

Figure S6. O spectrum of carbon materials after cycling at 10 A/g for 10000 cycles.

Tables

Table S1. Elemental compositions of all carbon samples by XPS (at%).

Sample	C	N	O	P	N+P+O
NODC	89.09	7.65	3.26	0	10.91
PNODC1	83.89	5.32	7.82	2.96	16.11
PNODC2	82.24	4.74	9.76	3.26	17.76