Nitrogen-phosphorous co-doped porous carbon from cross-linked polymers for supercapacitor applications

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Supporting information

The specific capacitance for the cell C_S (F g^{-1}) is given by the discharge part of the GCD curves using Eq. (S1) [1].

$$Cs = \frac{I\Delta t}{m\Delta V} \quad \text{(S1)}$$

Where I (in A) is the applied current, Δt (in seconds) is the discharging time from the GCD curves, m (in g) stands for the total mass of the electrode material, and ΔV (in V) is the operating voltage.

The specific energy E_d (W h kg^{-1}) and the specific power P_d (W kg^{-1}) for the fabricated symmetric supercapacitor were determined using:

$$E_d = \frac{C_S(\Delta V)^2}{7.2} \quad \text{(S2)}$$

$$P_d = 3600\ \frac{E_d}{\Delta t} \quad \text{(S3)}$$

Table. S1. Ratio of D to G of the of AC-PA/PP, AC-PA/PP/AP-0.25, AC-PA/PP/AP-0.5, AC-PA/PP/AP-0.75 samples.

Samples	I_D/I_G ratio
AC-PA-PP	0.83
AC-PA/PP/AP-0.25	0.85
AC-PA/PP/AP-0.5	0.86
AC-PA/PP/AP-0.75	0.84

Table. S2. XPS data and atomic percentage of C, O, P, N species.

Samples	Carbon	Oxygen	Phosphorous	Nitrogen
AC-PA/PP	89.34	9.66	0.00	1.00
AC-PA/PP/AP-0.25	89.79	9.23	0.14	0.84
AC-PA/PP/AP-0.5	87.13	10.91	0.71	1.25
AC-PA/PP/AP-0.75	91.25	7.65	0.10	1.00

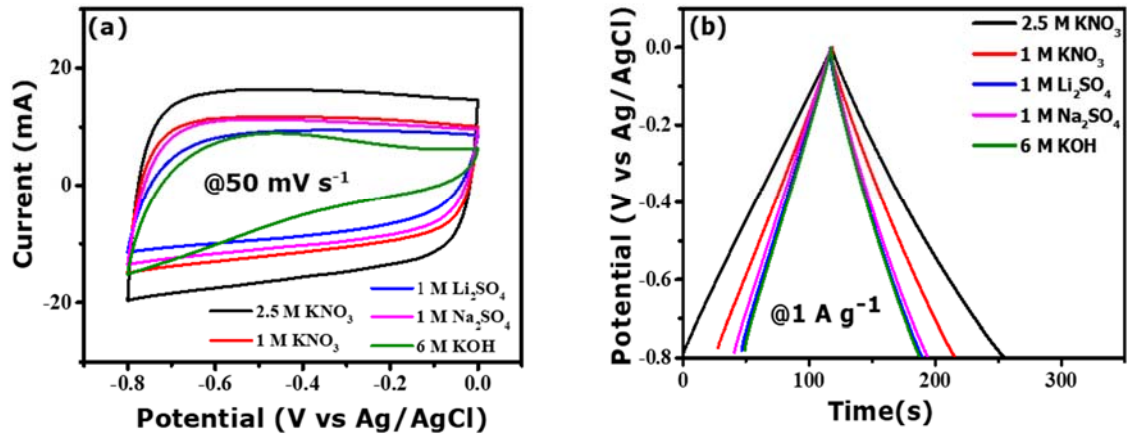


Fig. S1. Optimization of the electrolytes

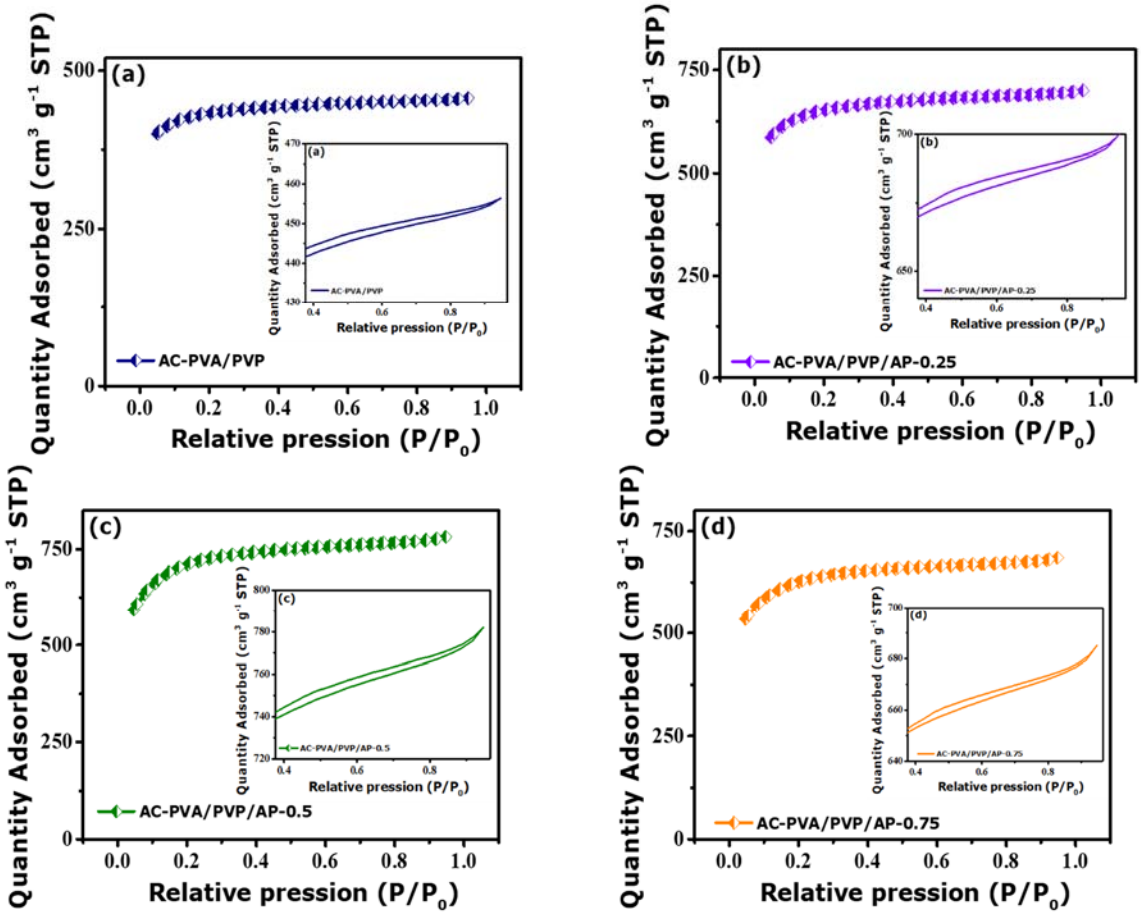


Fig. S2. Plot of the isotherms showing the hysteresis loop

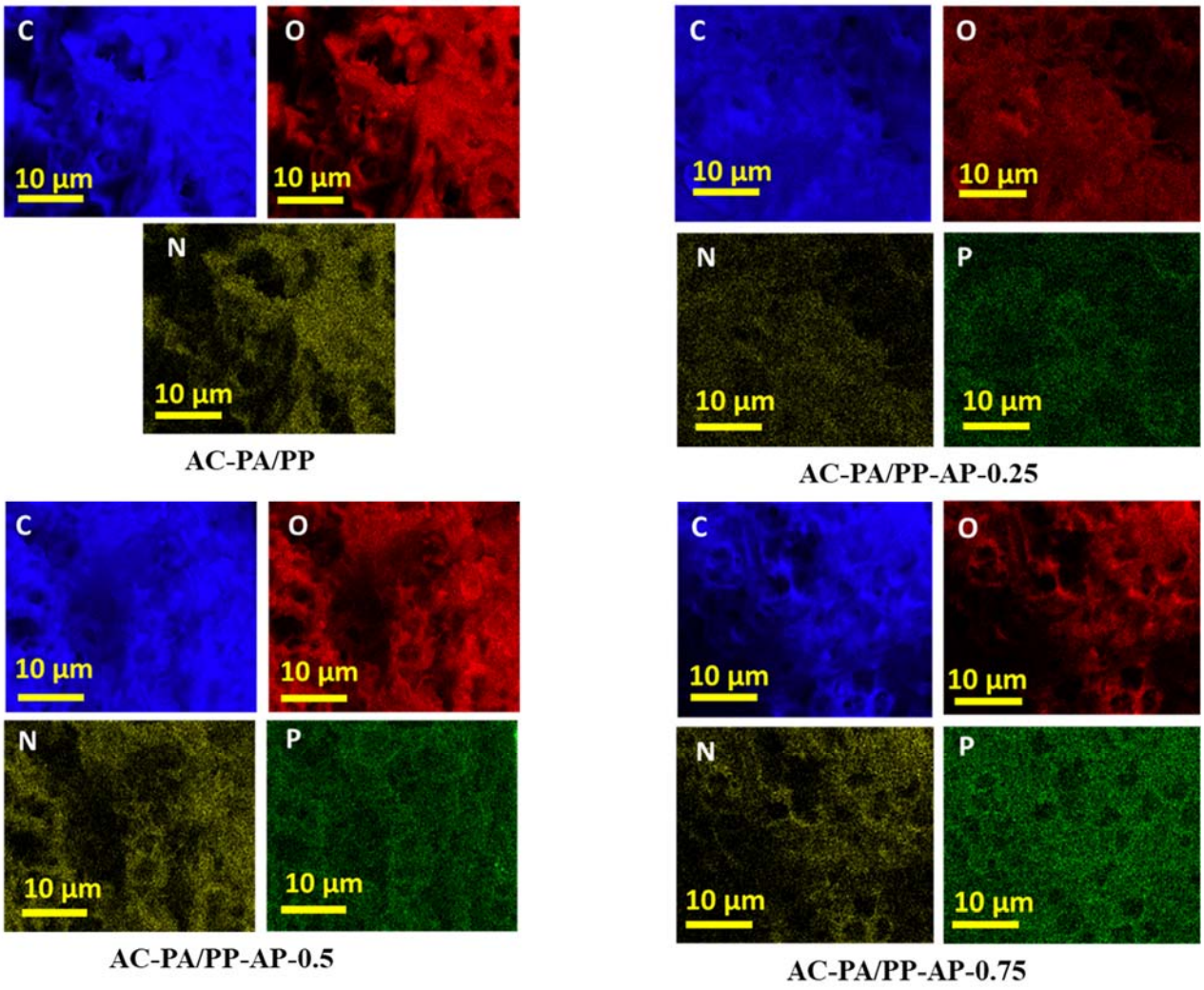
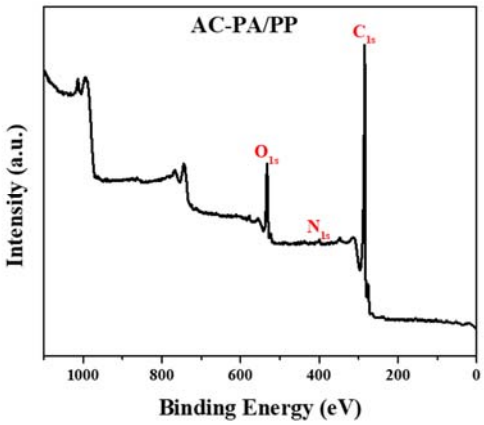
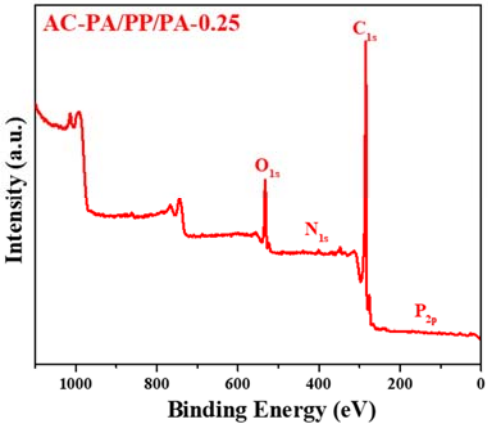


Fig. S3. EDS mapping of AC-PA/PVP, AC-PA/PP/AP-0.25, AC-PA/PP/AP-0.5, AC-PA/PP/AP-0.75 samples



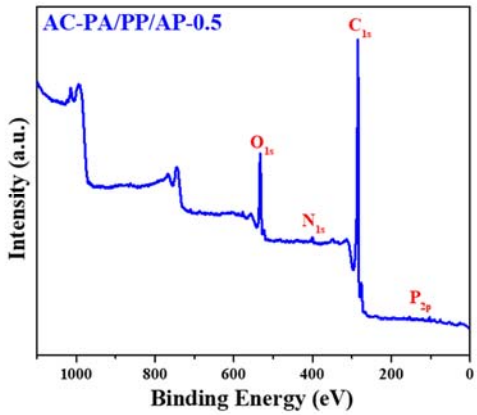
Name	Position (eV)	Raw Area	%At Conc
C 1s	284.62	133976	89.34
O 1s	532.82	47940.4	9.66
N 1s	400.32	2822.49	1.00

Fig. S4. XPS survey of AC/PA/PP with the details of the peaks



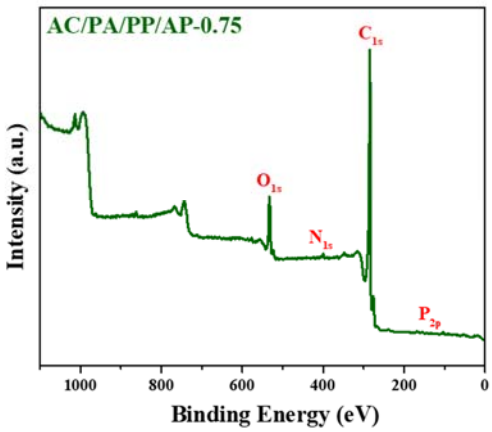
Name	Position (eV)	Raw Area	%At Conc
C 1s	284.62	145334	89.79
O 1s	532.72	49445.8	9.23
P 2p	133.92	173.718	0.14
N 1s	400.22	2564.96	0.84

Fig. S5. XPS survey of AC/PA/PP/AP-0.25 with the details of the peaks



Name	Position (eV)	Raw Area	% At Conc
C 1s	284.61	142598	87.13
O 1s	533.01	59081	10.91
P 2p	134.81	894.648	0.71
N 1s	400.41	3853.83	1.25

Fig. S6. XPS survey of AC/PA/PP/AP-0.5 with the details of the peaks



Name	Position (eV)	Raw Area	% At Conc
C 1s	284.61	142598	91.25
O 1s	533.01	59081	7.65
P 2p	134.81	894.648	0.10
N 1s	400.41	3853.83	1.00

Fig. S7. XPS survey of AC/PA/PP/AP-0.75 with the details of the peaks

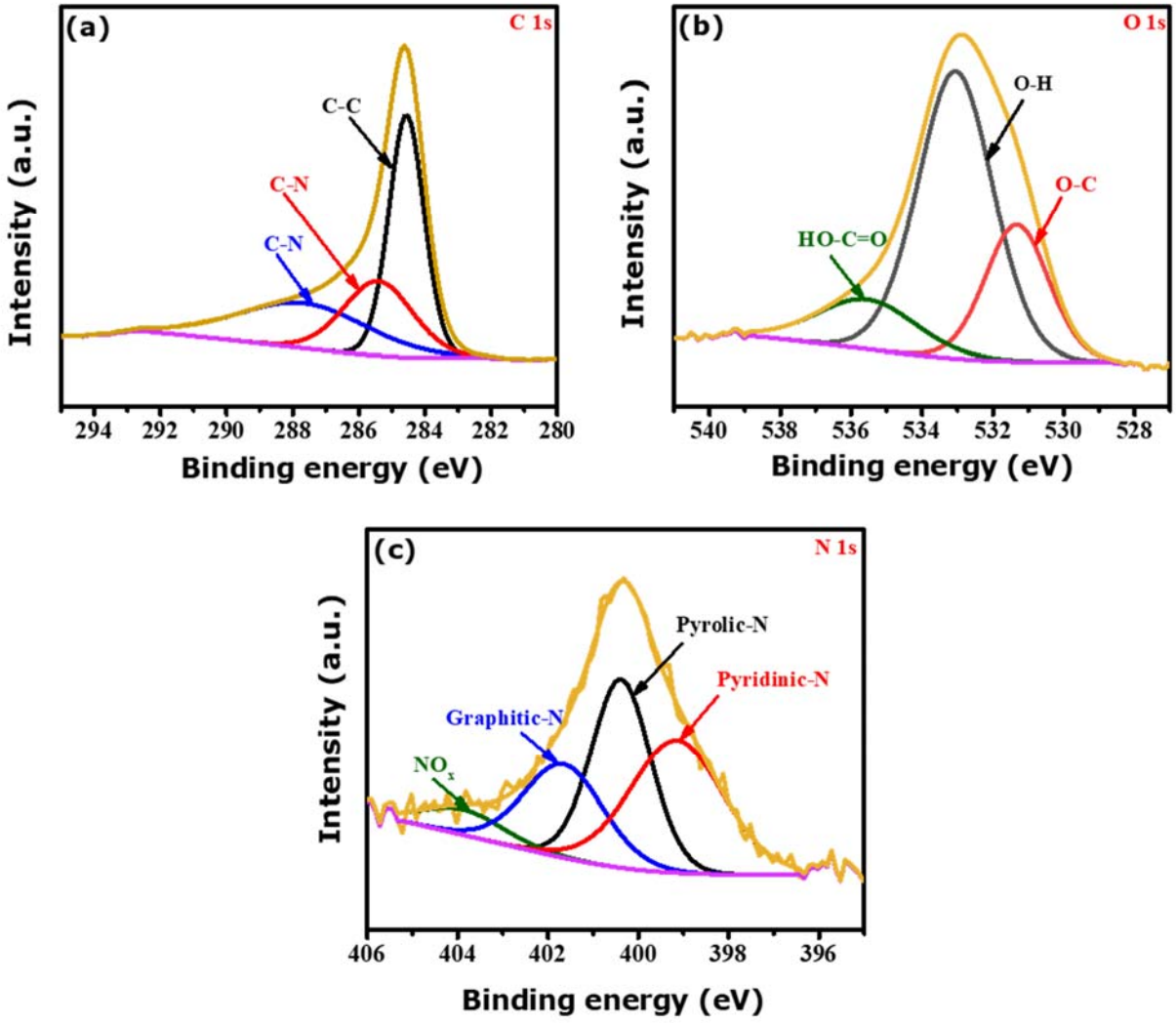


Fig. S8. XPS spectra deconvoluted (a) C1s (b) O1s (c) N1s of the as-synthesized AC-PA/PP

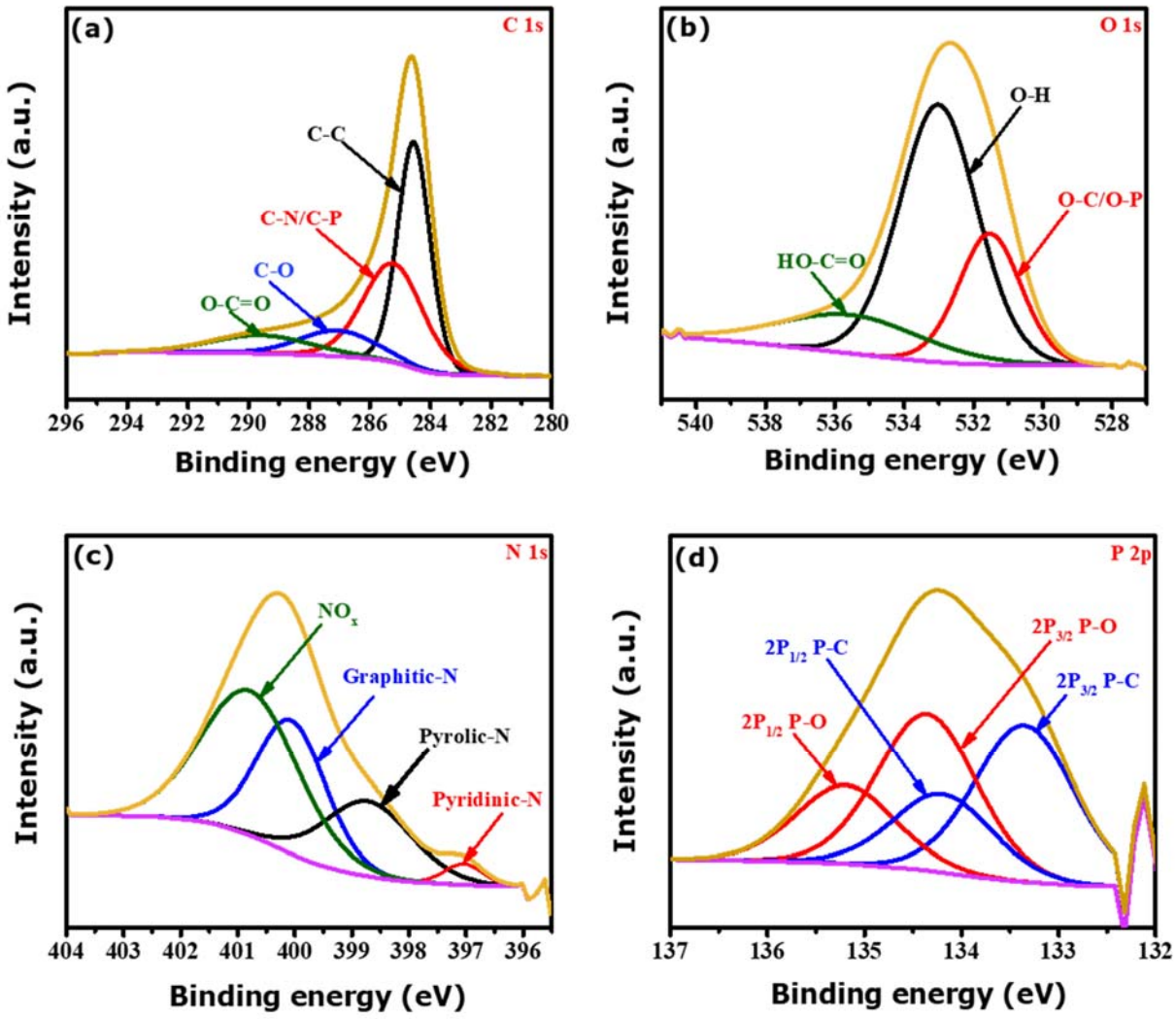


Fig. S9. XPS spectra deconvoluted (a) C1s (b) O1s (c) N1s (d) P2p of the as-synthesized AC-PA/PP/AP-0.25

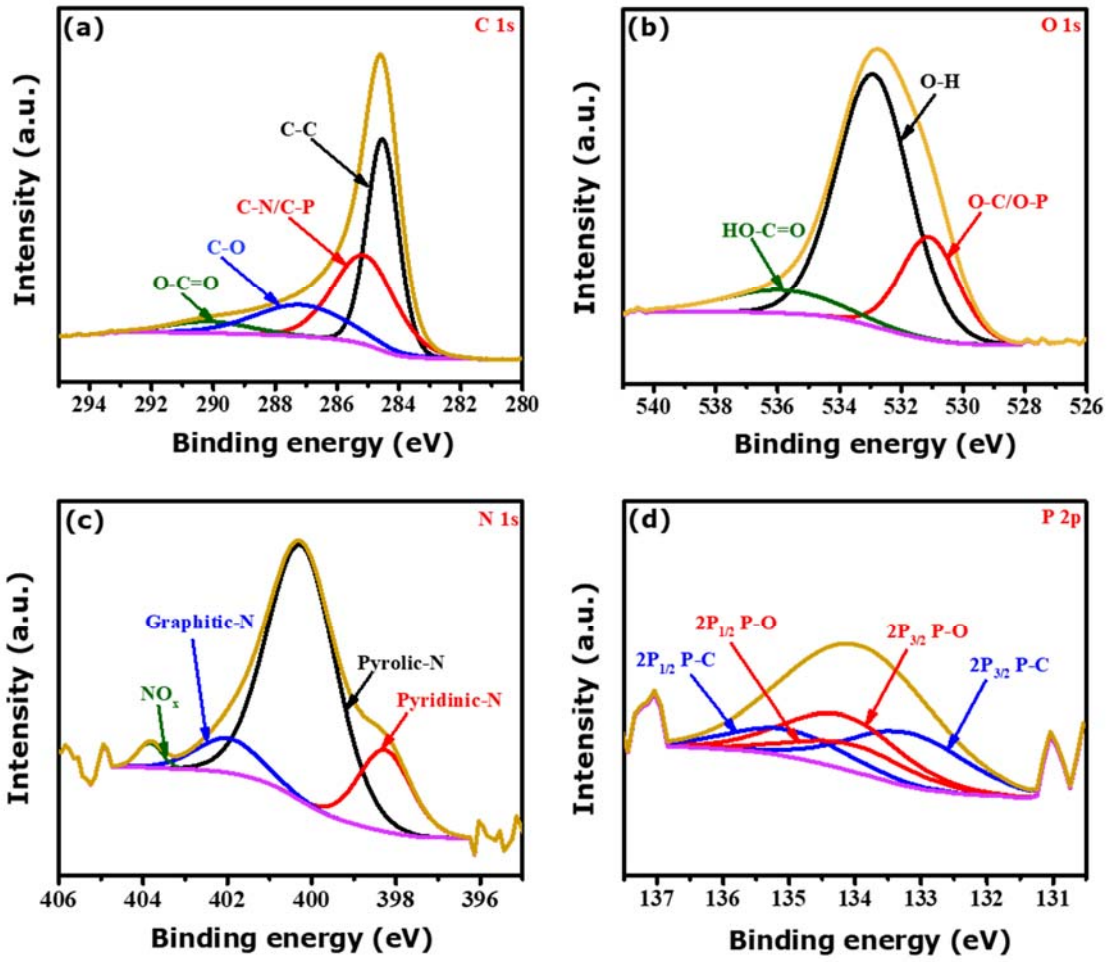


Fig. S10. XPS spectra deconvoluted (a) C1s (b) O1s (c) N1s (d) P2p of the as-synthesized AC-PA/PP/AP-0.75

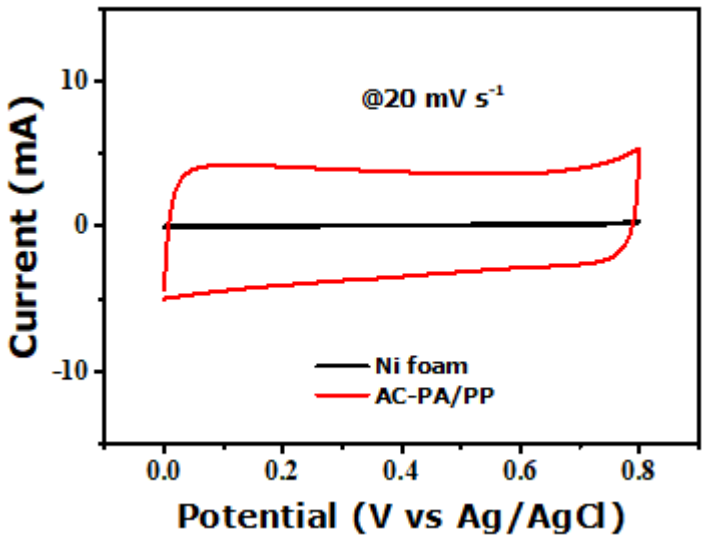


Fig. S11. Comparative CV of Ni foam and AC-PA/PP

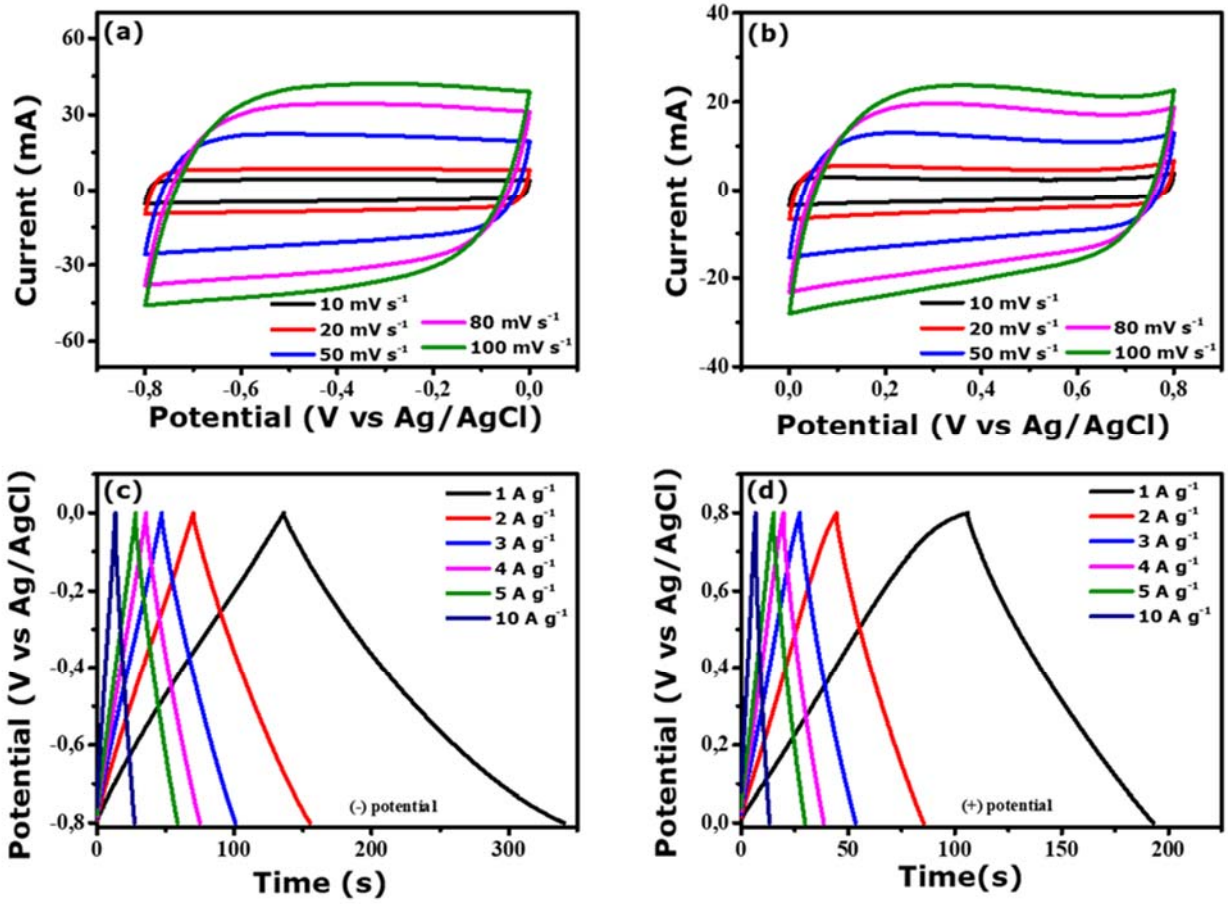


Fig. S12. (a) and (c) CV and GCD curves, and (b) and (d) CV and GCD curves of AC-PVA/PVP/AP-0.5 at various scan rates and specific currents measured in negative and positive working potential, respectively.

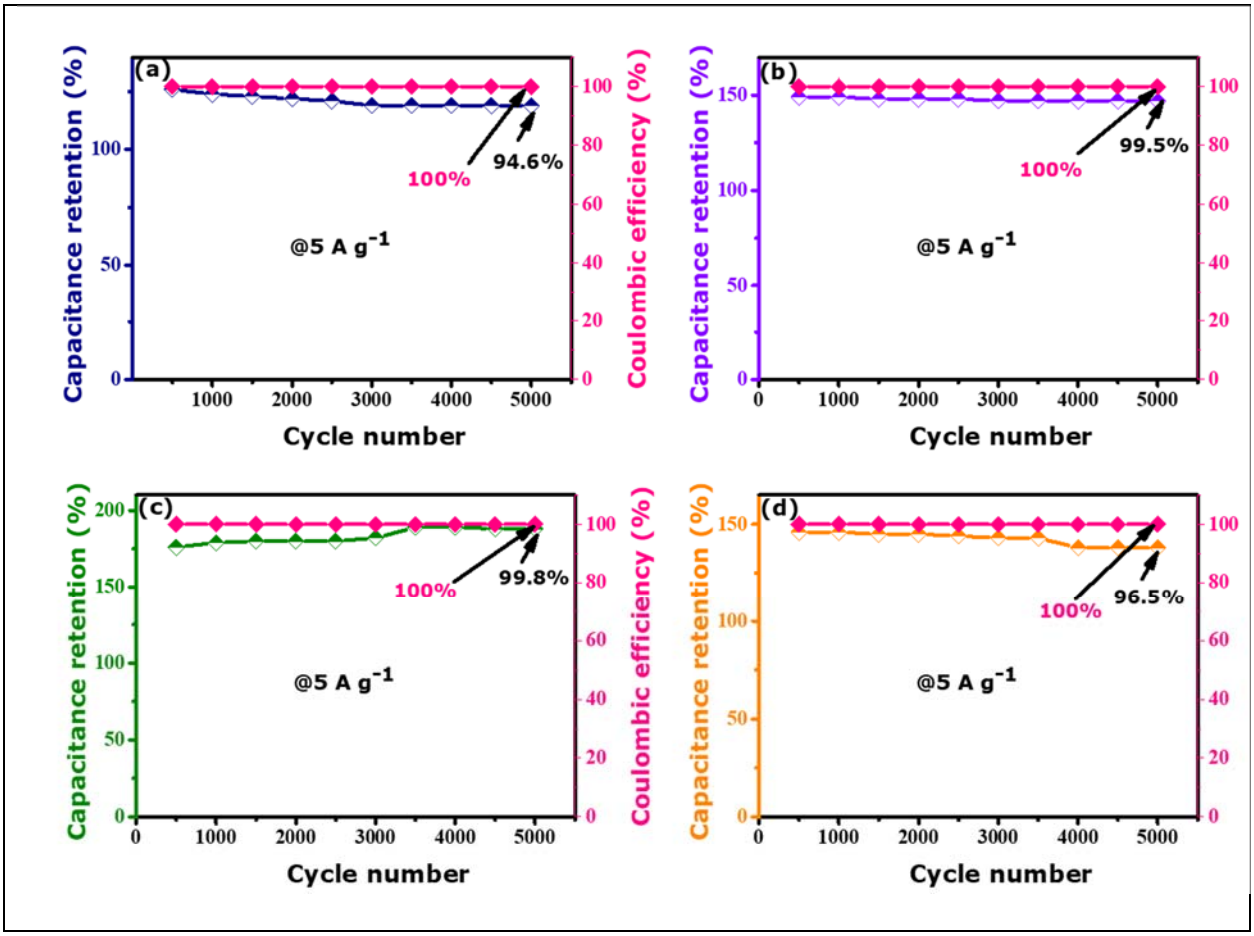


Fig. S13. (a) (b) (c) and (d) GCD cycling test analysis for AC-PA/PP, AC-PA/PP/AP-0.25 AC-PA/PP/AP-0.5 and AC-PA/PP/AP-0.75 electrodes, respectively, conducted for over 5000 cycles at 5 A g^{-1}.

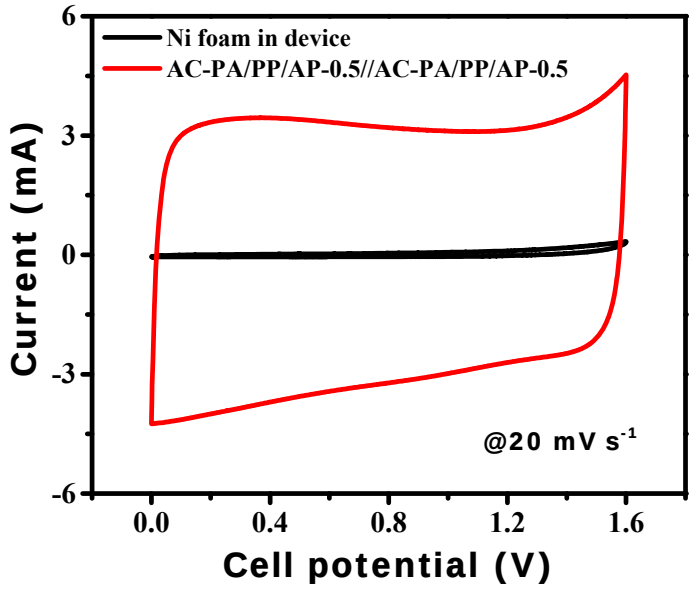


Fig. S14. Comparison between the Ni foam and the optimized sample.

Reference

[1] S. Osman, R.A. Senthil, J. Pan, L. Chai, Y. Sun, Y. Wu, Hierarchically activated porous carbon derived from zinc-based fluorine containing metal-organic framework as extremely high specific capacitance and rate performance electrode material for advanced supercapacitors, J. Colloid Interface Sci. 591 (2021) 9–19. https://doi.org/10.1016/j.jcis.2021.01.109.