Electronic Supplementary Information

Facile synthesis of crumpled nitrogen doped porous carbon nanosheets with ultrahigh surface area for high performance supercapacitors

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Characterizations

The morphology and microstructure of NPCNS, CNPCNS-700, CNPCNS-800 and CNPCNS-900 were characterized by scanning electron microscopy (SEM, JSU1510) and transmission electron microscopy (TEM, Jem-2100F Jeol). The thickness of NPCNS and CNPCNS-800 was detected by Bruker MultiMode-8 atomic force microscopy (AFM). Structure of NPCNS, CNPCNS-700, CNPCNS-800 and CNPCNS-900 were analyzed by X-ray diffraction (XRD, SmartLab3KW) and Raman spectrometer (XPLORA PLUS). The chemical composition and states of NPCNS, CNPCNS-700, CNPCNS-800 and CNPCNS-900 were analyzed by X-ray photoelectron spectroscopy (XPS, Thermo Escalab 250Xi). Nitrogen adsorption-desorption isotherms of NPCNS, CNPCNS-700, CNPCNS-800 and CNPCNS-900 were tested by an ASAP-2020 at 77 K.

Electrochemical measurements

The three-electrode and two-electrode systems were used to evaluate the capacitance performances of NPCNS, CNPCNS-700, CNPCNS-800 and CNPCNS-900 at room temperature. To prepare the electrodes, active materials (80 wt%), acetylene black (15 wt%) and polytetrafluoroethylene binder (5 wt%) were mixed together using ethanol to make a slurry, which was coated onto uniform thickness nickel foam sheets (1.0 cm × 1.0 cm) under 10 MPa followed by drying at 100 °C for 12 h. The loading weight of the active materials in electrode was about 1 mg cm^{-2}. For the three-electrode system, NPCNS or CNPCNS electrode and Pt foil electrode were used as the working and counter electrodes, and the Hg/HgO served as the reference electrode. For the two-electrode system, the symmetric supercapacitor was assembled by two identical electrodes as a 2025 stainless steel coin cell, using glass fiber as the separator, and 1-ethyl-3-methylimidazolium tetrafluoroborate ($EMIMBF_4$) were used as the electrolyte, respectively. The cyclic voltammetry (CV), galvanostatic charge-discharge (GCD) and electrochemical impedance spectra (EIS) measurements were measured by a CHI660E

electrochemical workstation (ChenHua, Shanghai). The EIS measurements were conducted in the frequency ranging from 100 kHz to 10 mHz with a perturbation amplitude of 5 mV versus the open circuit potential.

For the three electrode systems, the gravimetric capacitance C (F g^{-1}) was calculated according to the galvanostatic tests based on the equation:

$$C = \frac{I\Delta t}{m\Delta V} \quad (1)$$

where I (A) is the discharge current; Δt (s) is the discharge time; ΔV (V) is the potential window; and m (g) is the mass of the active materials.

For the two electrode systems, the gravimetric capacitance C (F g^{-1}) was calculated from the galvanostatic tests based on the equation:

$$C = \frac{4I\Delta t}{m\Delta V} \quad (2)$$

where I (A) is the discharge current; Δt (s) is the discharge time; ΔV (V) is the potential window; m (g) is the total mass of the active materials on the two electrodes.

Energy density E (Wh kg^{-1}) and power density P (W kg^{-1}) of the symmetric supercapacitors were calculated from the equations:

$$E = \frac{1}{8} C\, \Delta V^2 \quad (3)$$

$$P = \frac{E}{\Delta t} \quad (4)$$

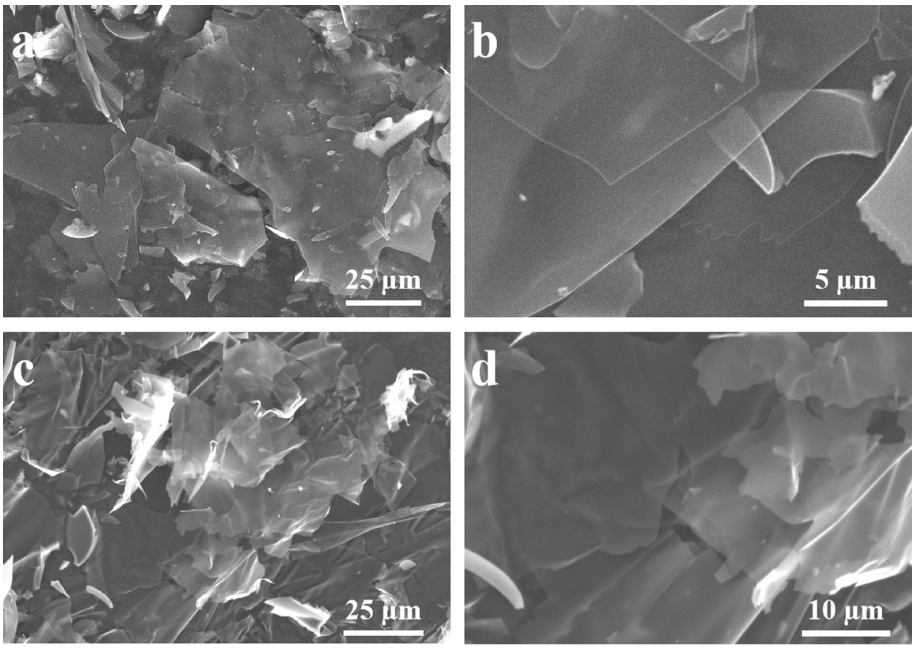

Fig. S1 (a,b) SEM images of adenosine derived carbon obtained by heating adenosine to 700 °C for 2 h. (c,d) SEM images of pentose derived carbon obtained by heating pentose to 700 °C for 2 h.

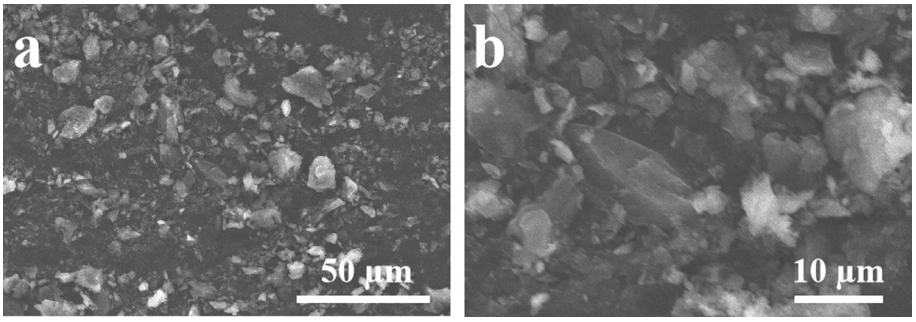

Fig. S2 SEM images of adenine derived carbon obtained by heating adenine to 700 °C for 2 h.

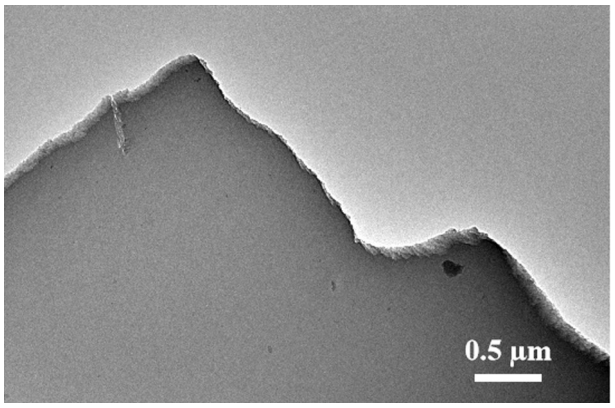

Fig. S3 TEM image of NPCNS.

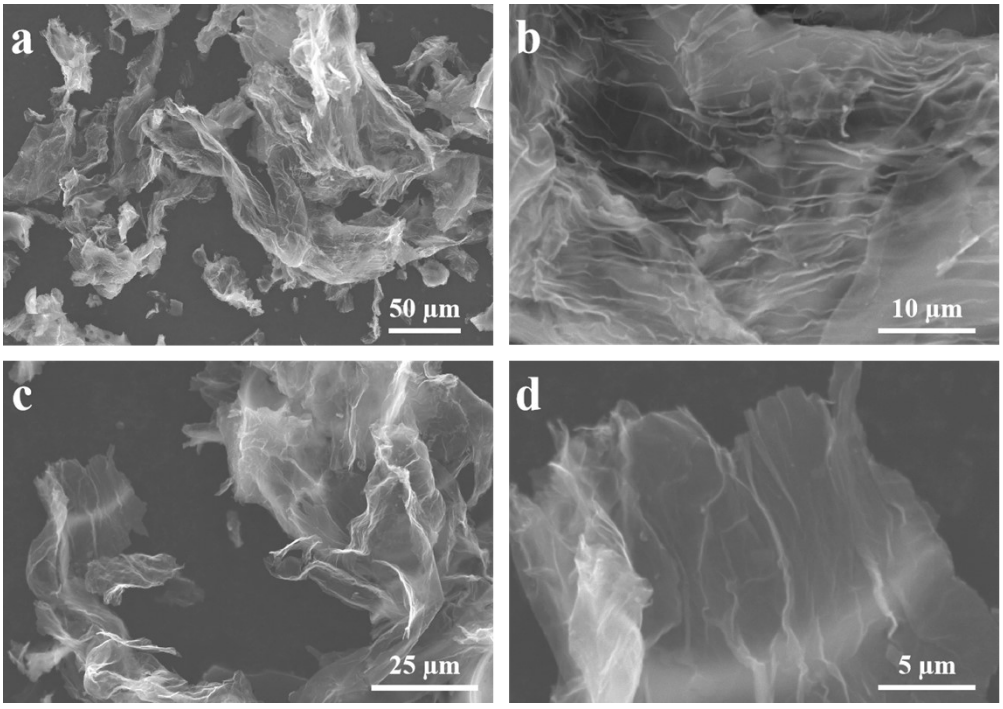

Fig. S4 SEM images of CNPCNS-700 and CNPCNS-900.

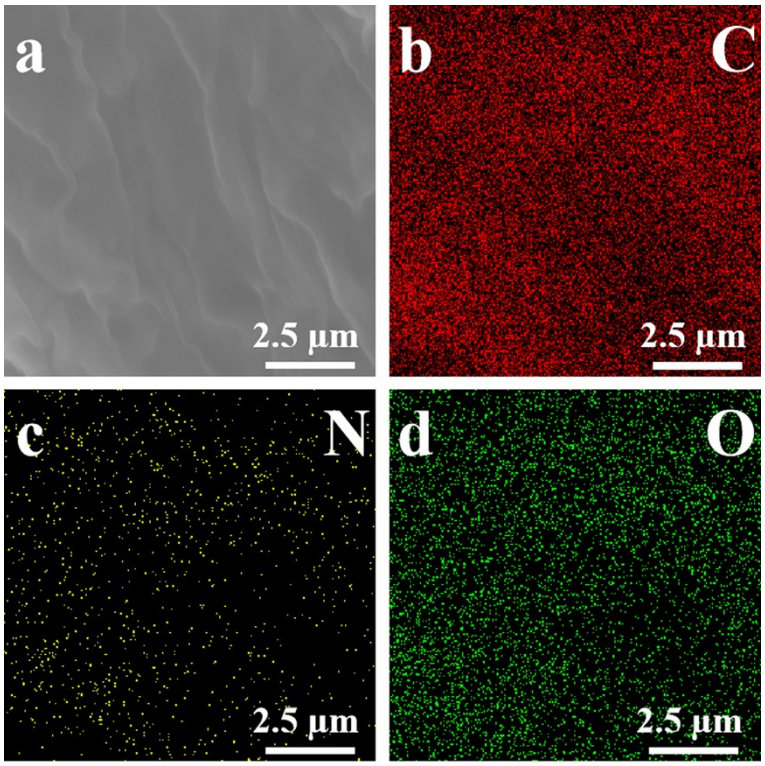

Fig. S5 EDX elemental mapping images of CNPCNS-800.

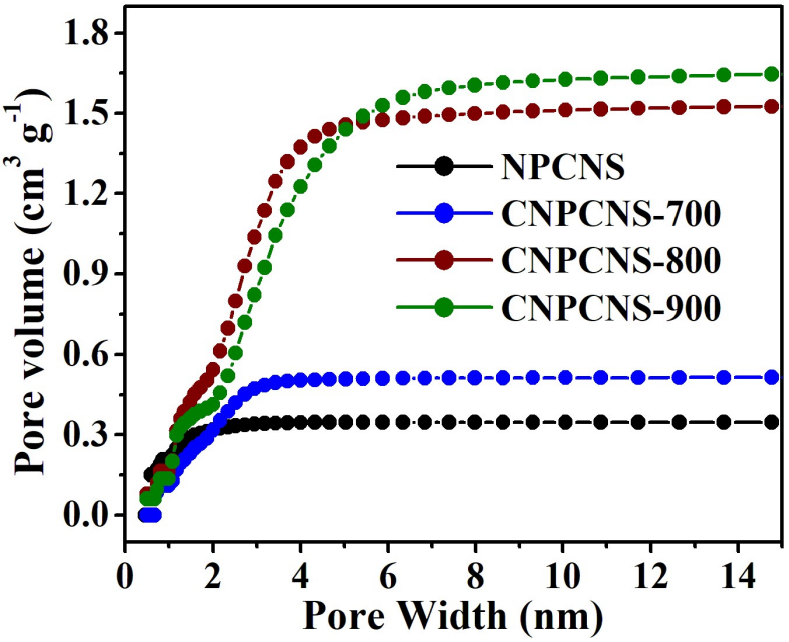

Fig. S6 Cumulative pore volume of NPCNS, CNPCNS-700, CNPCNS-800 and CNPCNS-900.

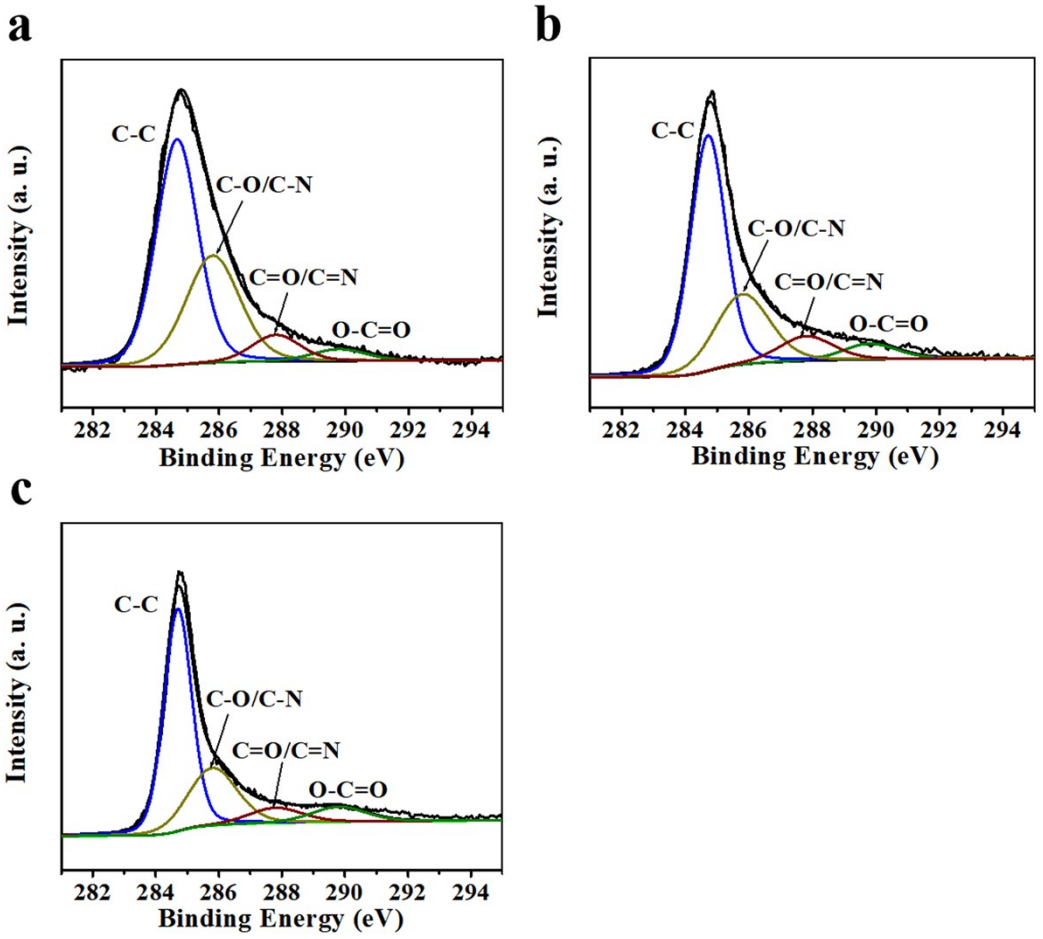

Fig. S7. C1s spectrum of (a) NPCNS, (b) CNPCNS-700 and (c) CNPCNS-900.

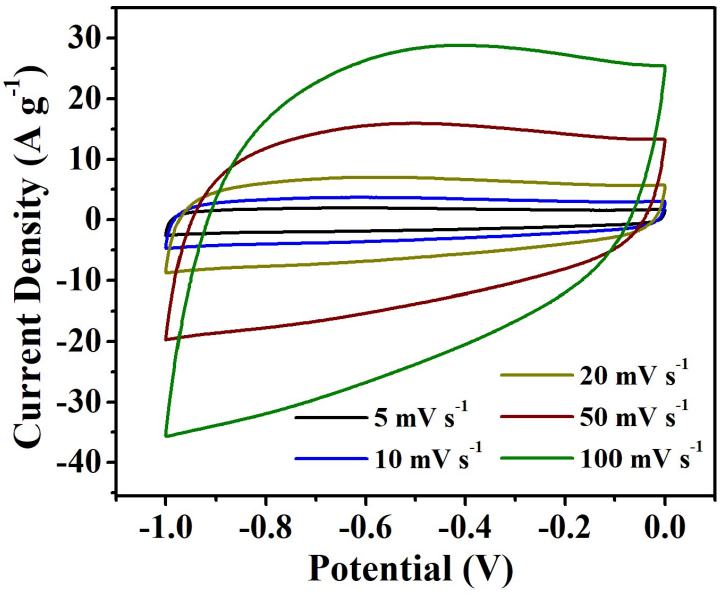

Fig. S8. CV curves of CNPCNS-800 electrode at the scan rates from 5 to 100 mV s^{-1} in the 6 M KOH.

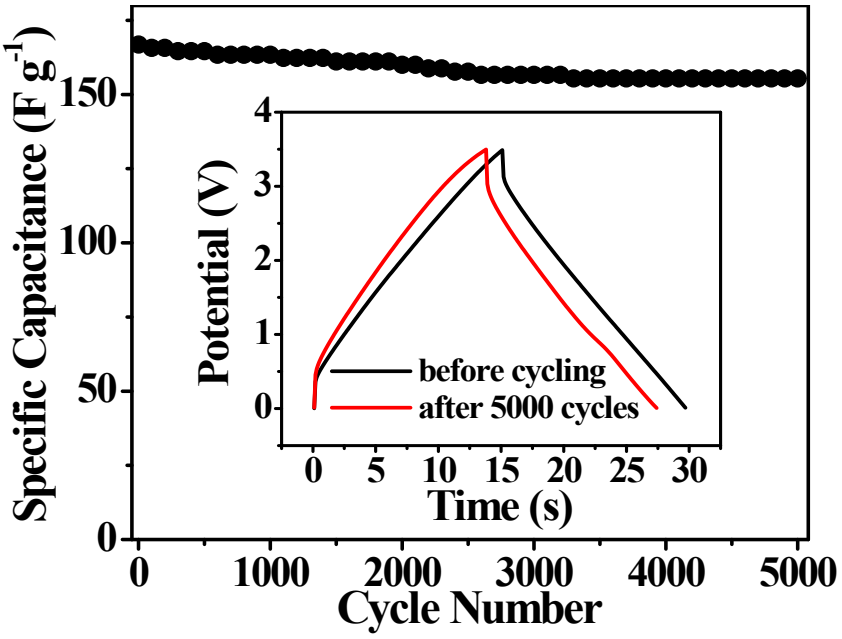

Fig. S9 The long-term cycling stability of CNPCNS-800 in $EMIMBF_4$. The inset of shows the GCD curves before and after 5000 GCD cycles at 10 A g^{-1}.