Supporting information

Synthesis of hierarchical nanoporous carbon material with controllable pore size and effective surface area for high-performance electrochemical capacitors

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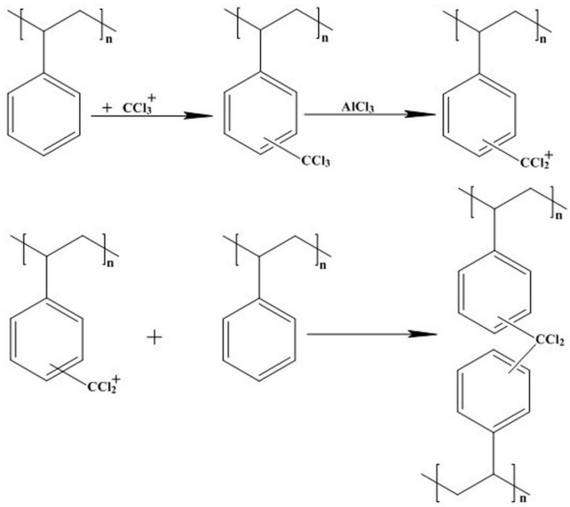
This supporting information includes:

Scheme S1, Scheme S2, Table S1, Table S2, Figure S1, Figure S2, Figure S3, Figure S4， Figure S5, Figure S6 and Figure S7

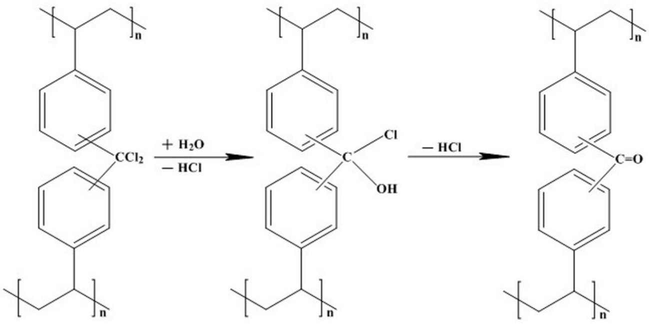
(1) Formation of carbocation $^{+}CCl_3$

$$CCl_4 \xrightarrow{AlCl_3} CCl_3^{+}$$

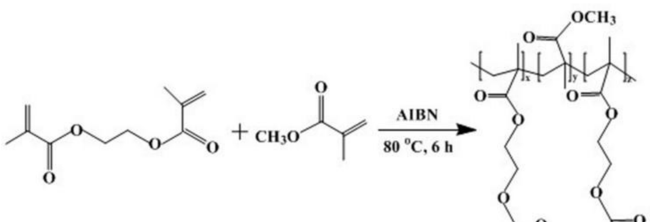
(2) Formation of $-CCl_2-$ crosslinking bridges



(3) Formation of -CO- crosslinking bridges



Scheme S1 Formation mechanism of -CO- crosslinking bridge for (I) polymer network of IPN.



Scheme S2 Formation mechanism of (II) polymer network of IPN.

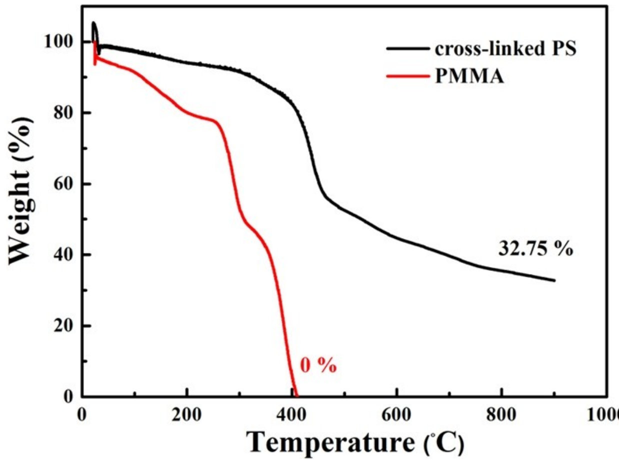


Figure S1 TGA curves of the cross-linked PS and PMMA.

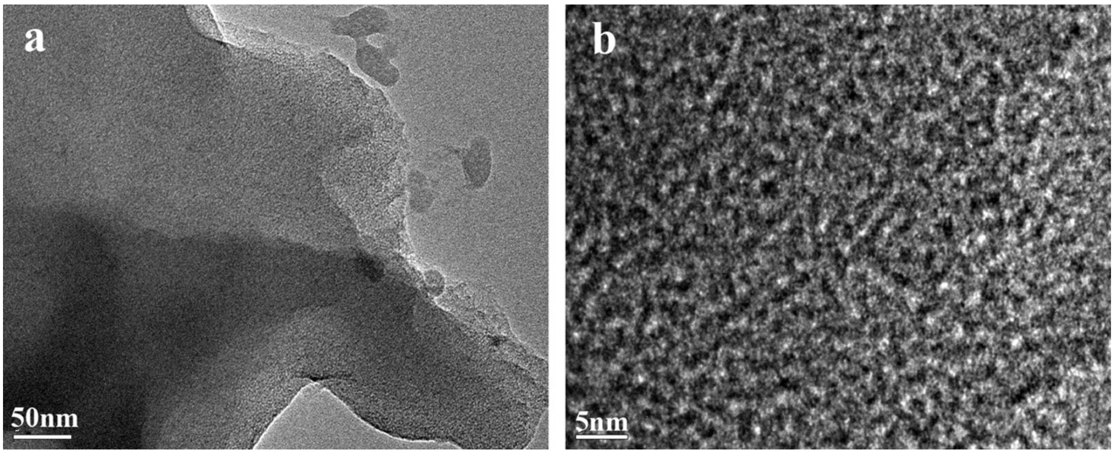


Figure S2 TEM images of (a) HNC synthesized cross-linked PS pyrolysis; HRTEM images of (b) HNC.

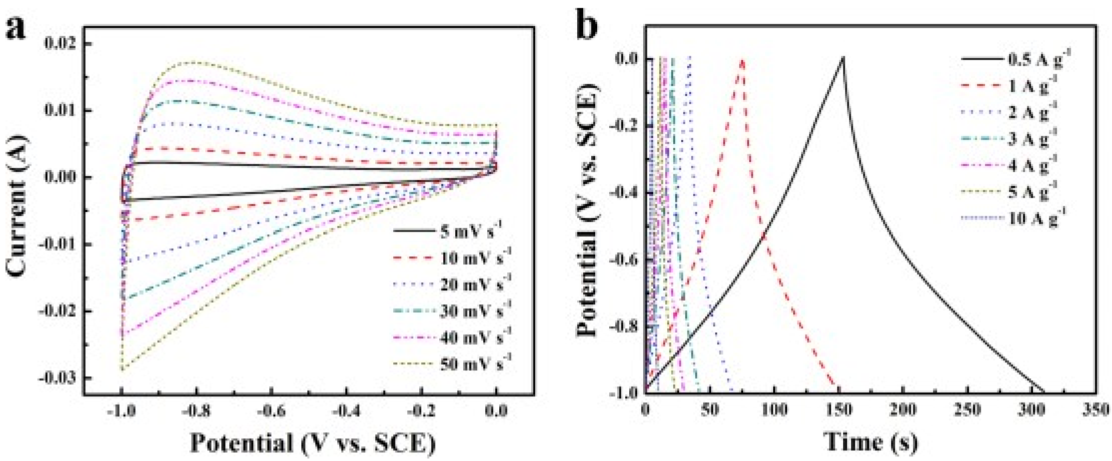


Figure S3 Electrochemical performance of HNC electrode in 6 mol L^{-1} KOH aqueous electrolyte: (a) CV curves measured at different scan rates from 5 to 50 mV s^{-1} with a potential window from -1 to 0V; (b) Galvanostatic charge-discharge curves measured at different current densities from 0.5 to 10 A g^{-1}.

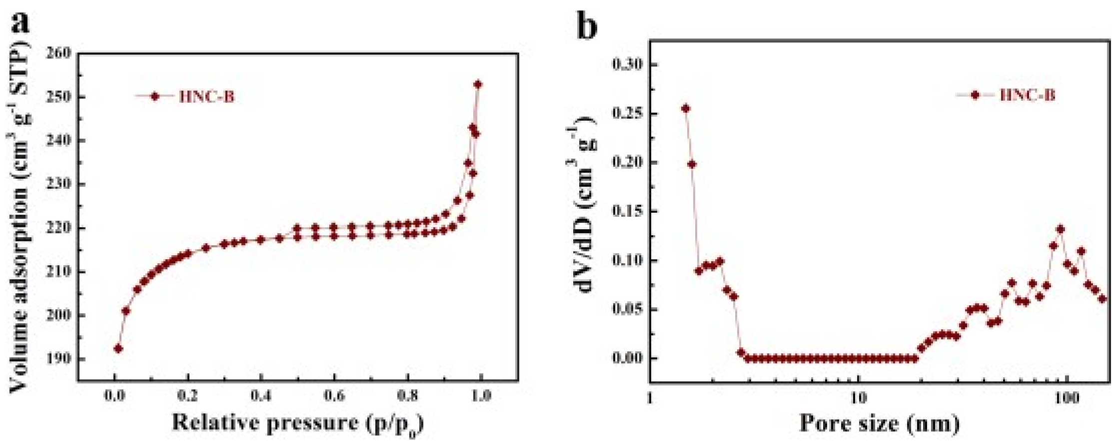


Figure S4 (a) N_2 adsorption-desorption isotherms and (b) pore size distributions corresponding to the HNC-B pyrolysed by PS/PMMA polymer blend with the mass ratio of 20/80.

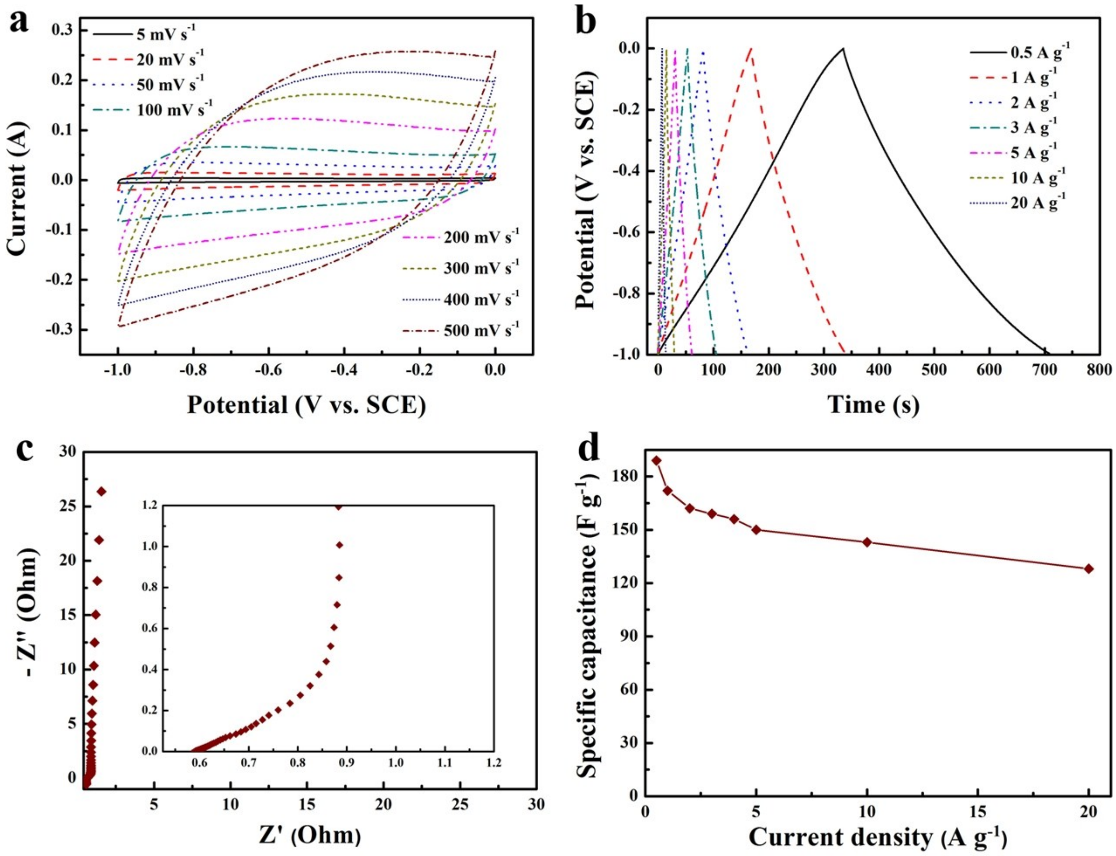


Figure S5 Electrochemical performance of HNC-B pyrolysed by PS/PMMA blend with the mass ratio of 20/80 in 6 mol L^{-1} KOH aqueous electrolyte: (a) CV curves measured at different scan rates from 5 to 500 mV s^{-1} with a potential window from -1 to 0V; (b) Galvanostatic charge-discharge curves measured at different current densities from 0.5 to 20 A g^{-1}; (c) EIS curve measured in the frequency range from 10^{-5} to 10^{-2} Hz at the open circuit potential with an alternate current amplitude of 5 mV; (d) Specific capacitances of the HNC-B under different current densities ranging from 0.5 to 20 A g^{-1};

Table S1

Sample	PS/PMMA (mg/mg)	S_{BET} [a] (m^2g^{-1})	S_{mic} [b] (m^2g^{-1})	S_{meso} [c] (m^2g^{-1})	V_{total} [d] (cm^3g^{-1})	V_{mic} [e] (cm^3g^{-1})	V_{mic}/V_{total} (%)	D_a [f] (nm)	C_g [h] (Fg^{-1})
HNC-B	20/80	608	505	103	0.35	0.28	80	2.3	189

[a] The specific surface areas were calculated using the BET method. [b] Micropore surface area. [c] Mesopore surface area. [d] Total pore volume measured at P/P_0 =0.99. [e] Micropore volume. [f] The average pore diameters were calculated from the adsorption of the isotherms by using the DFT model. [h] Calculated from the galvanostatic discharge curve at the current density at 0.5 A g^{-1} in 6M KOH aqueous electrolyte based on the three-electrode system.

Table S2 Parameters determined by Raman spectrum of HNC, HNC-IPN-1, HNC-IPN-2, HNC-IPN-3，HNC-IPN-4 and HNC-IPN-5.

Sample	Peak position (cm^{-1})		Peak area		L_a (nm)
	D	G	D	G	
HNC	1335	1596	878576	416226	2.06
HNC-IPN-1	1336	1595	233720	120833	2.25
HNC-IPN-2	1337	1592	356920	186890	2.27
HNC-IPN-3	1346	1591	1444296	760805	2.29
HNC-IPN-4	1348	1591	1167767	622419	2.31
HNC-IPN-5	1343	1592	296346	193217	2.28

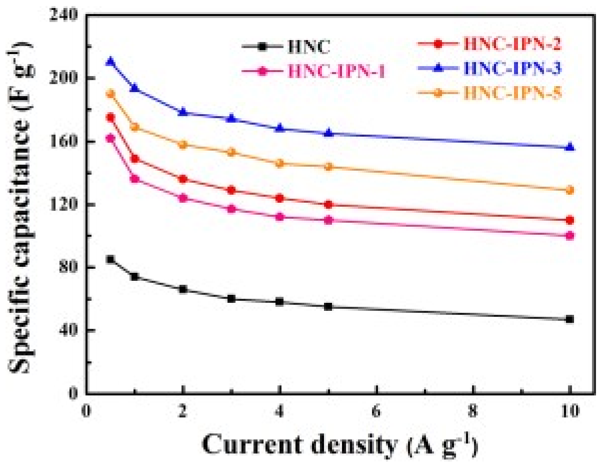


Figure S6 Specific capacitance of the four carbons at different current densities ranging from 0.5 to 10 A g^{-1}.

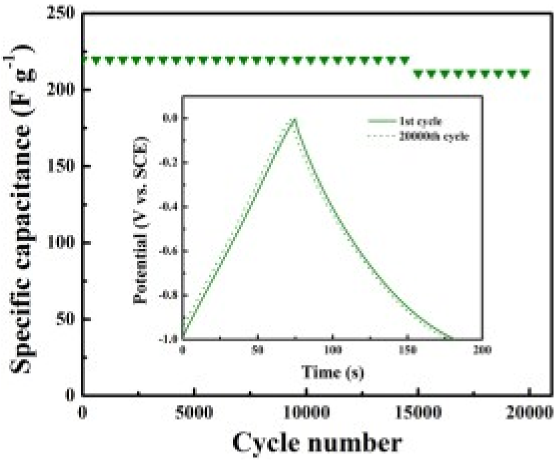


Figure S7 Cycling performance of the HNC-IPN-4 electrode in 6 M KOH aqueous electrolyte. And the galvanostatic charge-discharge curves (shown as an inset) before and after 20 000 cycles. Data were obtained from a three-electrode system by using the galvanostatic charge-discharge technique with a current density of 2 A g^{-1}.