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Support Information

A Facile Template Approach to Nitrogen-doped Hierarchical Porous Carbon Nanospheres from Polydopamine for High-performance Supercapacitors

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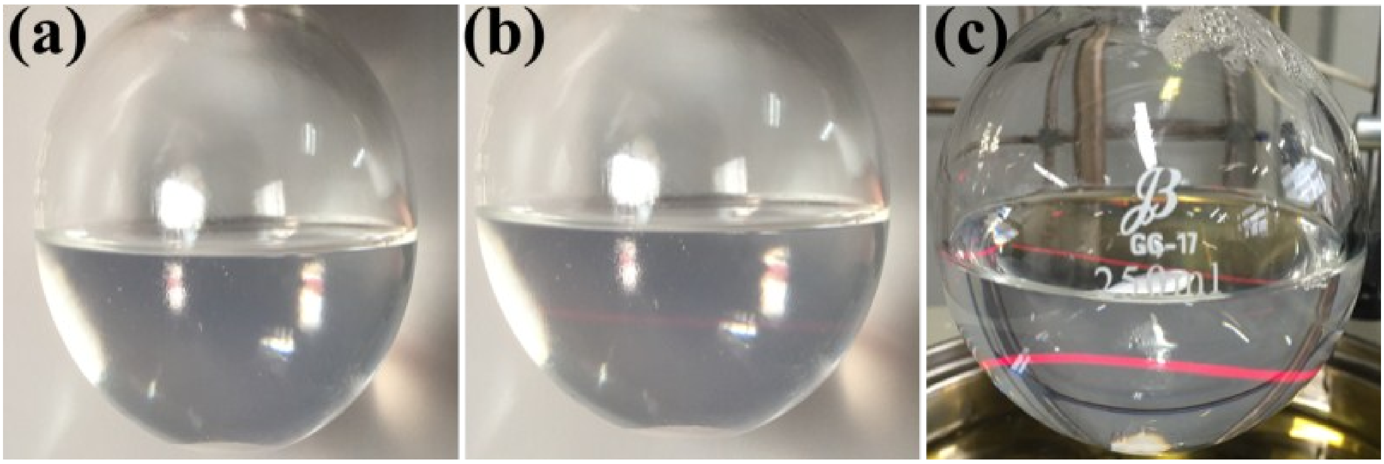

Figure S1. Photographs of F127 dissolved in water at temperature of (a) 15 ^oC, (b) 30 ^oC, and (c) 90 ^oC.

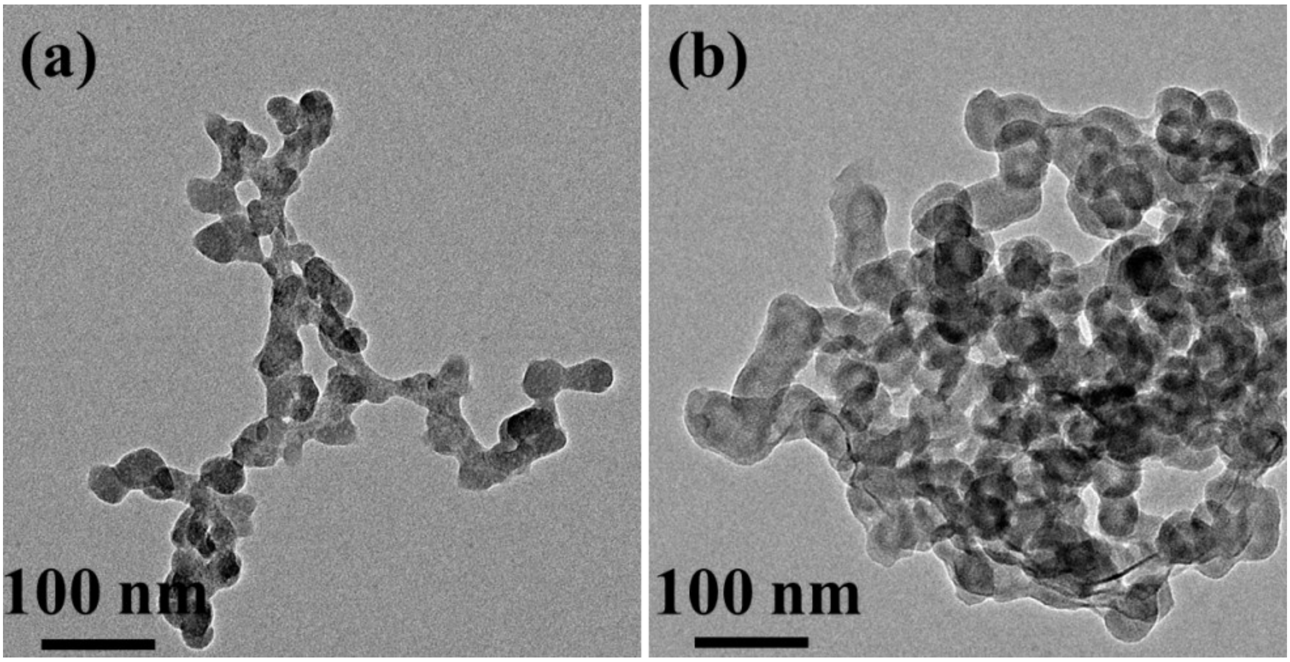

Figure S2. TEM images of resulting products at different temperature, (a) 50 ^oC, (b) 70 ^oC.

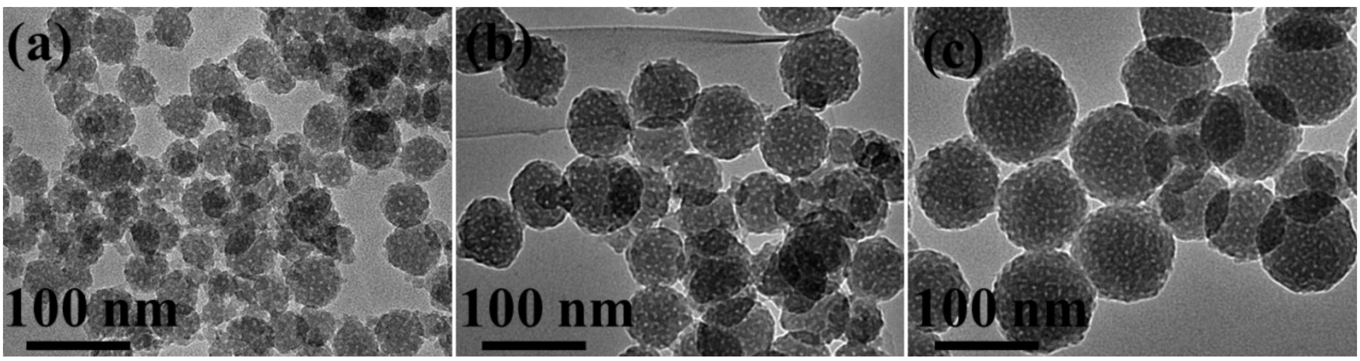

Figure S3. TEM of MNPSs images at different molar ratio of dopamine to F127: (a) 110, (b) 55, (c) 33

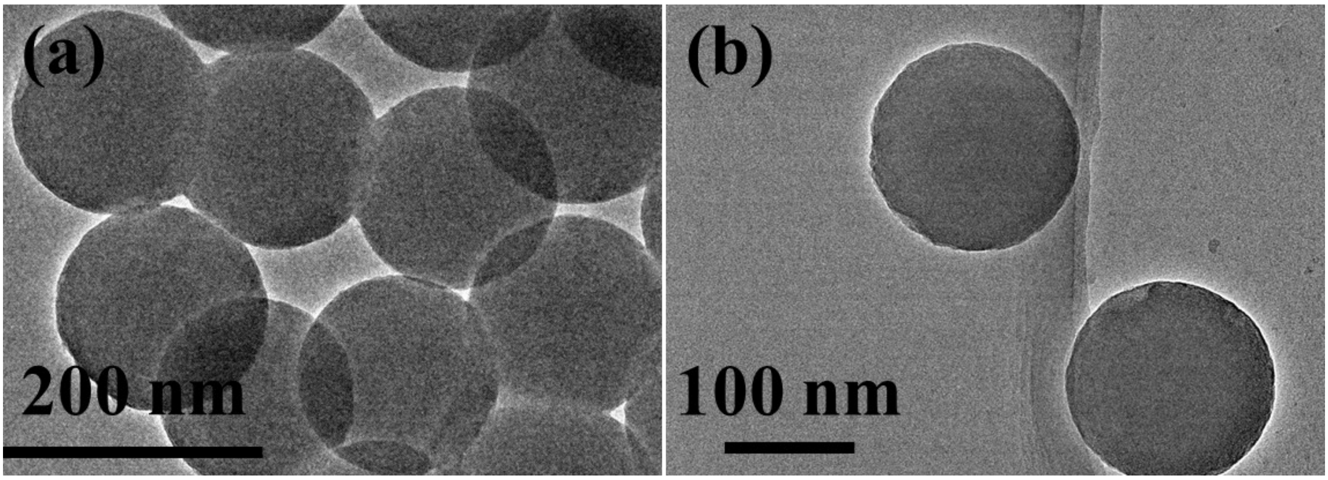

Figure S4. TEM images of PDACS-700.

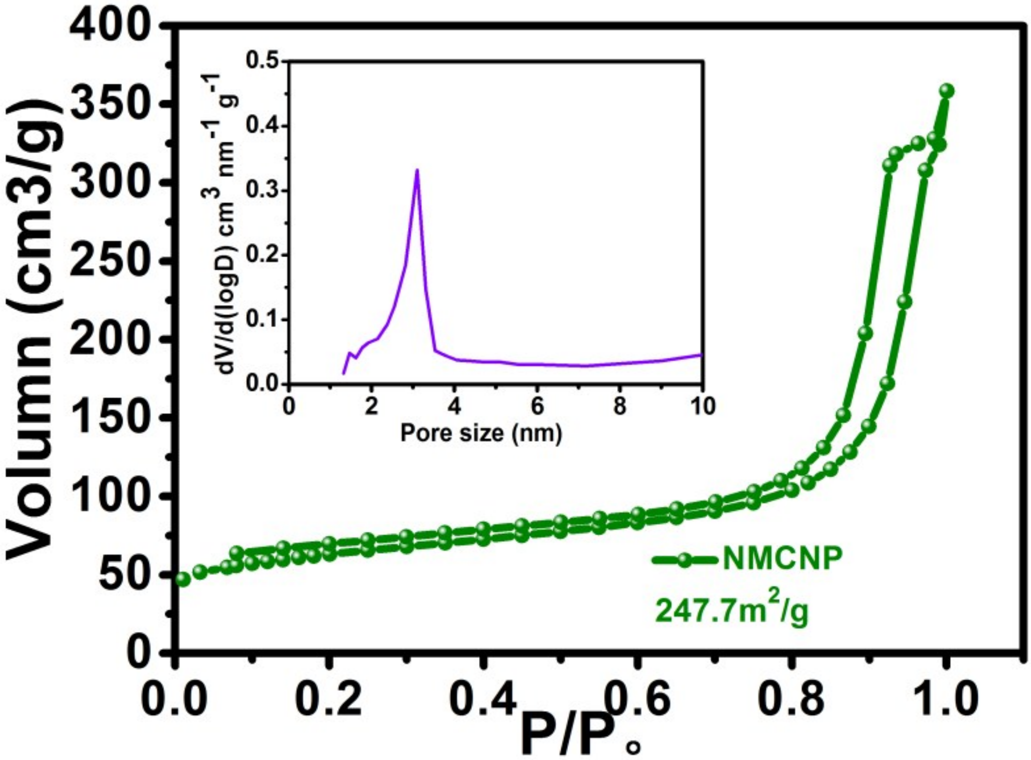

Figure S5. Nitrogen adsorption–desorption isotherms and pore size distributions (inset) of NMCNP.

Section 1. Electrochemical performance of NHPCN-700-based coin-type symmetric EDLC cells

The coin-type (2025 type) symmetric EDLC cells using the NHPCN-700 as active electrode materials were fabricated for studying the electrochemical performance of the as-prepared carbon materials. NHPCN-700-assembled EDLC cells are constructed using organic electrolyte solutions of tetraethylammonium tetrafluoroborate/acetonitrile ($TEABF_4$/AN) (1M). The glass fiber filter papers (Whatman, GF-B) were used as separators. The galvanostatic charge/discharge curves of assembled EDLC cells based on NHPCN-700 were added in supporting information. The electrodes could be stably operated at 2.8 V without obvious polarization and IR drop.

The specific capacitances of the symmetric supercapacitors were calculated using the following equation $C_s = 2I\Delta t/(m\Delta V)$.where I is the constant discharge current, t is the time for a full discharge, m is the mass of active material in one electrode, and ΔV is voltage drop on discharge (excluding the internal resistance (IR) drop). The energy density of the cells was calculated by $E = C_s V^2/8$, where V is the cell operating voltage. The various power densities of the device (P) were calculated from the following formula $P = E/t$, where t is the discharge time. The NHPCN-700-based supercapacitor can deliver an energy density up to 18.9 Wh kg^{-1} at a power density of 0.12 kW kg^{-1}. Moreover, even at a high power density of 2.5 kW kg^{-1}, the energy density remains high, at 8.4 Wh kg^{-1}.

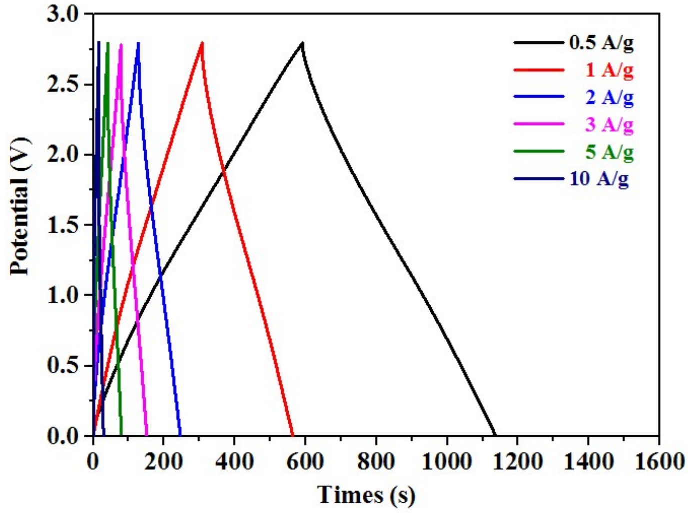

Figure S6. Galvanostatic charge-discharge curves of the NHPCN-700 symmetric supercapacitor in 1 M tetraethylammonium tetrafluoroborate/acetonitrile ($TEABF_4$/AN) electrolyte at different scan rates and an operation voltage of 2.8 V.

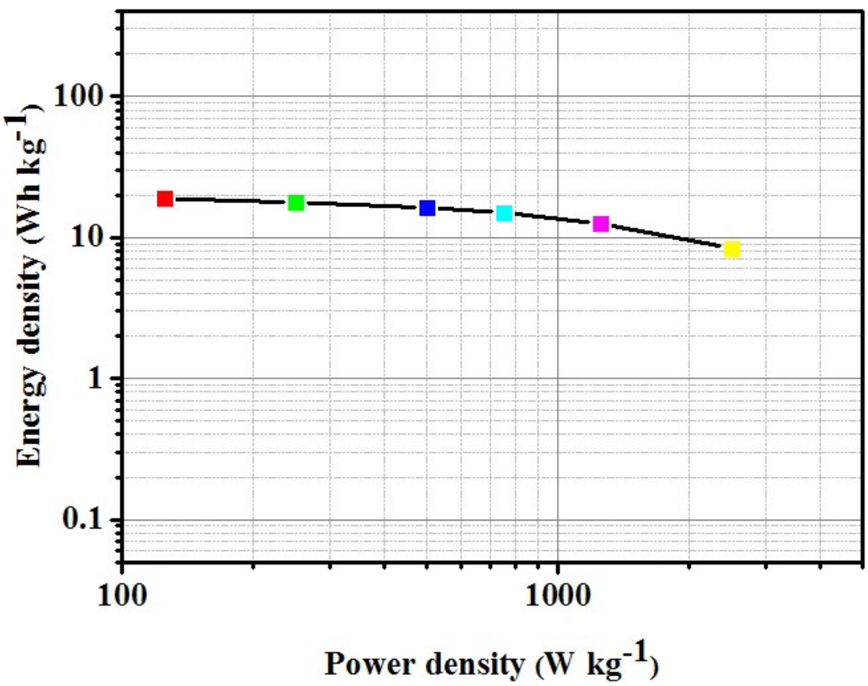

Figure S7. The power and energy densities of NHPCN-700-based coin-type symmetric supercapacitor

Section 2. Analysis of electrochemical impedance spectroscopy (EIS)

The EIS of as-prepared carbon electrodes and the equivalent circuit diagram used for the fitting of the EIS are displayed in Figure S8 and in the inset. The equivalent circuit for the electrodes was constructed by the following elements: the bulk solution resistance, R_S, the contact capacitance, C_C(CPE1), which was expected in parallel with the contact resistance, R_c, and a Warburg diffusion element (W) attributable to the diffusion of ions. Besides, the capacitive nature of the carbon-based electrodes in the low-frequency domain could be reasonably presented as a low-frequency capacitance, C_L(CPE2), in parallel with a charge transfer resistance, R_{ct}. After fitting EIS spectra using the equivalent circuit diagram, from Table S1, the NHPCN-700 with the smallest size meant its lowest charge transfer resistance (0.2174 Ω); NHPCN-600 (0.3286 Ω) and NHPCN-800 (0.3764 Ω) have similar charge transfer resistance while PDACS-700 showed the highest charge transfer resistance (0.7976 Ω). CPE2 (C_L) of carbon-based electrode is the most concerned parameter, indicating the specific double-layer capacitance. Based on the EIS data, the C_L of NHPCN-700 is higher than that of PADCS-700, NHPCN-600 and NHPCN-800, indicates a more contribution of meso- and micropores.

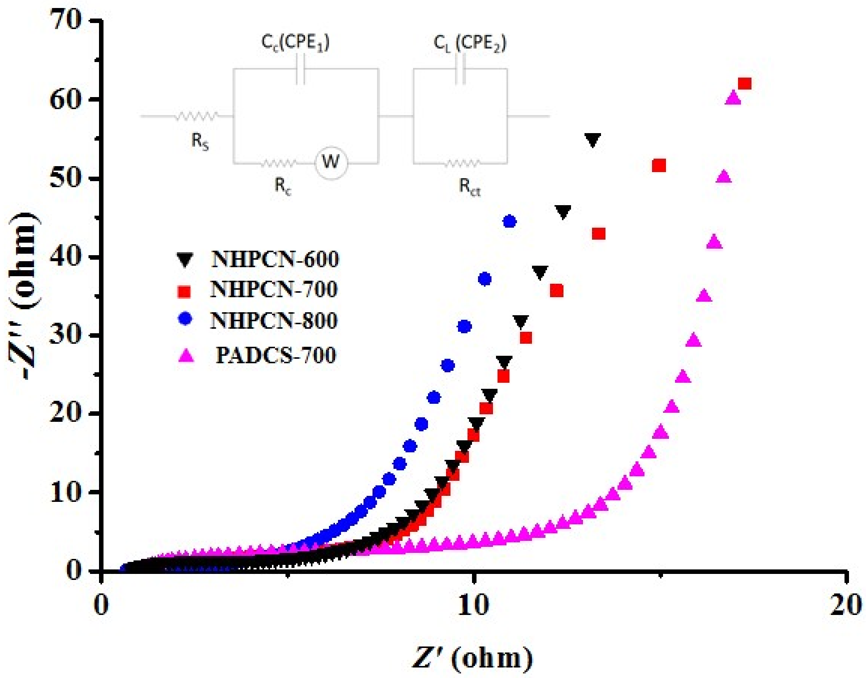

Figure S8. Electrochemical impedance spectra (EIS) of as-prepared carbon-based electrodes and equivalent circuit diagram.

Table S1 The fitting values of the equivalent circuit elements in Figure S8 from the simulation of the impedance data for as-prepared carbon-based electrodes

	PADCS-700	NHPCN-600	NHPCN-700	NHPCN-800
Rs (Ω)	0.7685	1.192	1.12	0.808
Rct (Ω)	0.7976	0.3286	0.2174	0.3764
CPE1(μF)	0.1925	0.4969	0.2958	0.3231
CPE2(F/g)	17.85	19.11	22.79	20.96