Supporting Information

MOF-derived NiO/Ni Architecture Encapsulated into N-doped Carbon Nanotubes for advanced asymmetric supercapacitors

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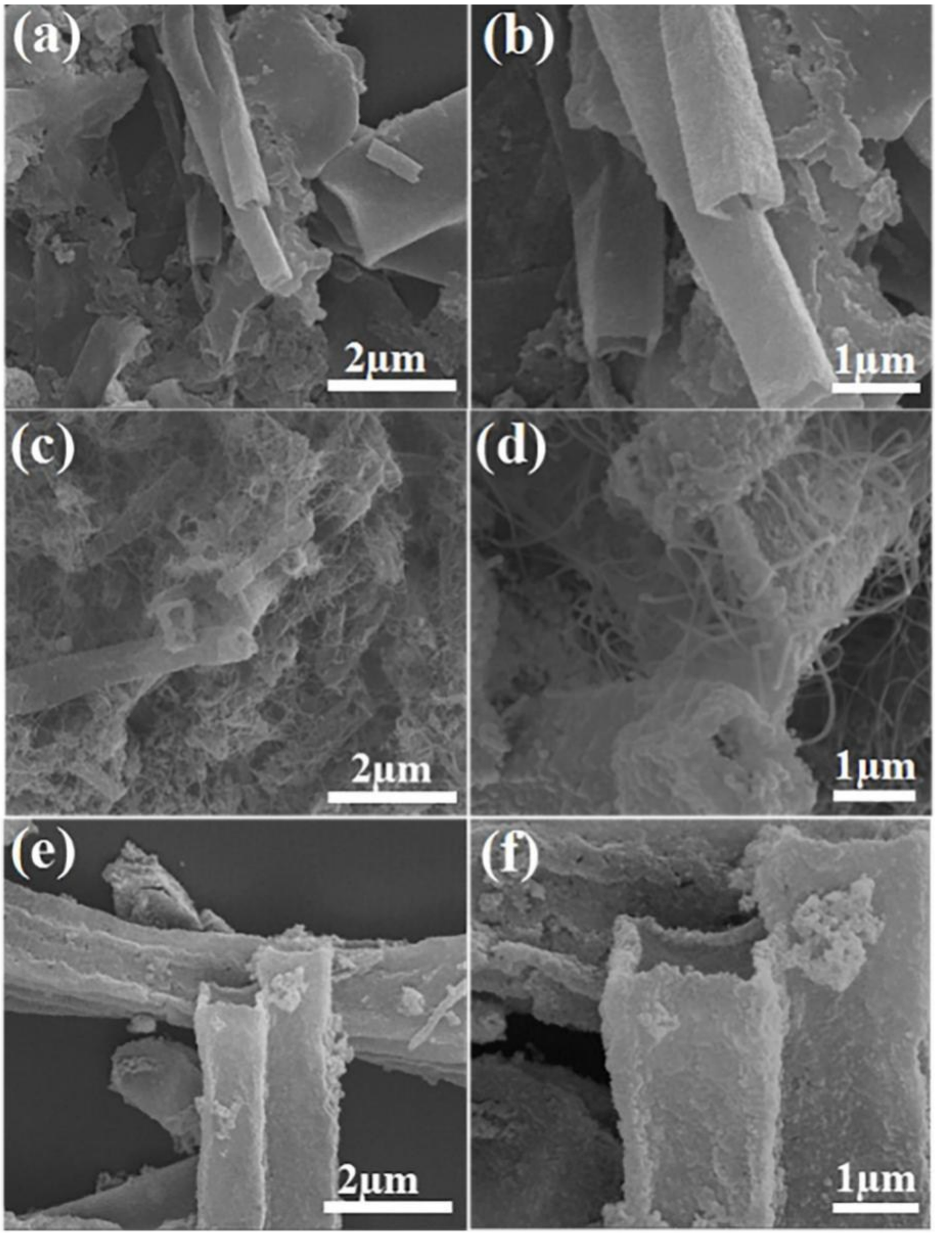


Fig. S1 SEM images of (a, b) Ni-MOF-500, (c, d) Ni-MOF-600, (e, f) Ni-MOF-700.

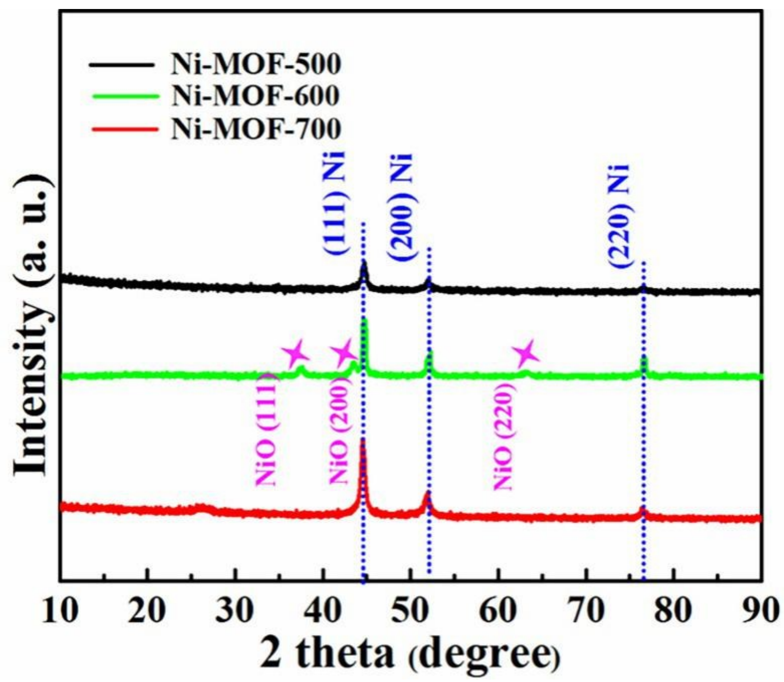


Fig. S2 XRD patterns of Ni-MOF-X (X=500, 600, 700).

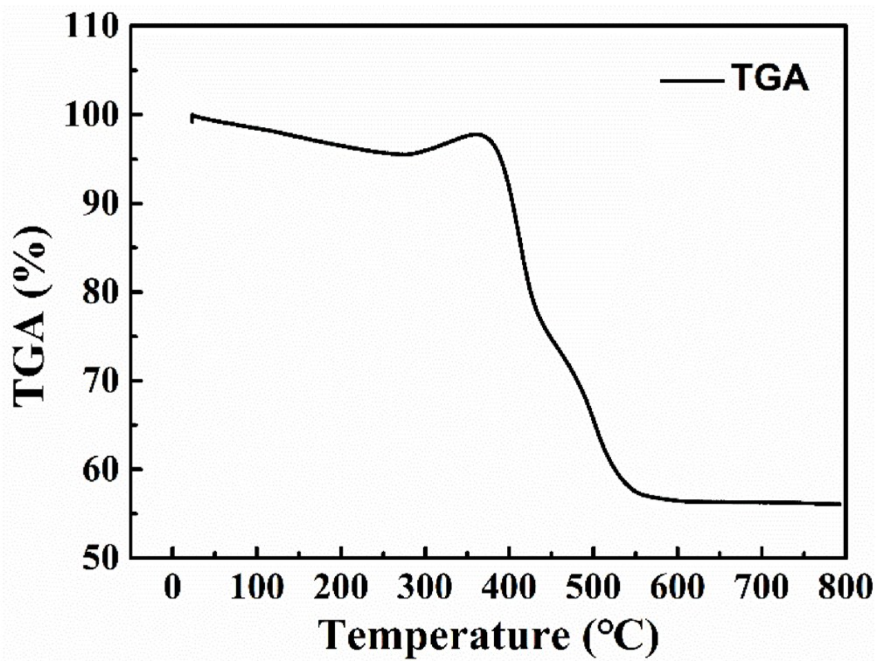
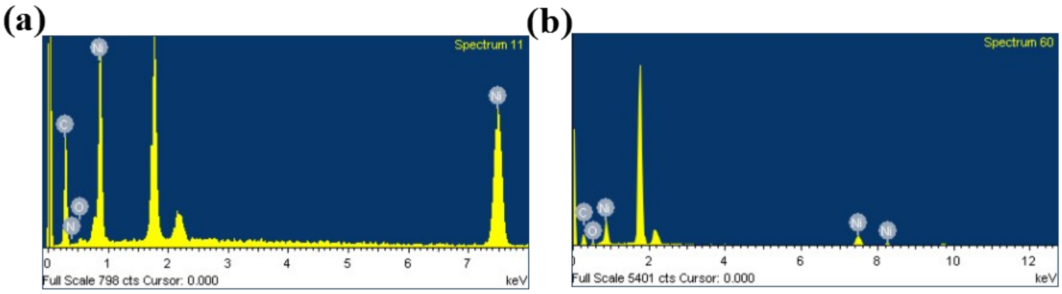


Fig. S3 TGA curve of Ni-MOF-600.



(c)

	Ni-MOF-600	NiO/Ni/NCNT
Element	Atomic%	Atomic%
Ni	17.37	13.58
O	1.54	6.92
C	78.49	77.80
N	2.60	1.70

Fig. S4 (a) EDX spectrum of Ni-MOF-600, (b) EDX spectrum of NiO/Ni/NCNTs, (c) The corresponding elements distribution.

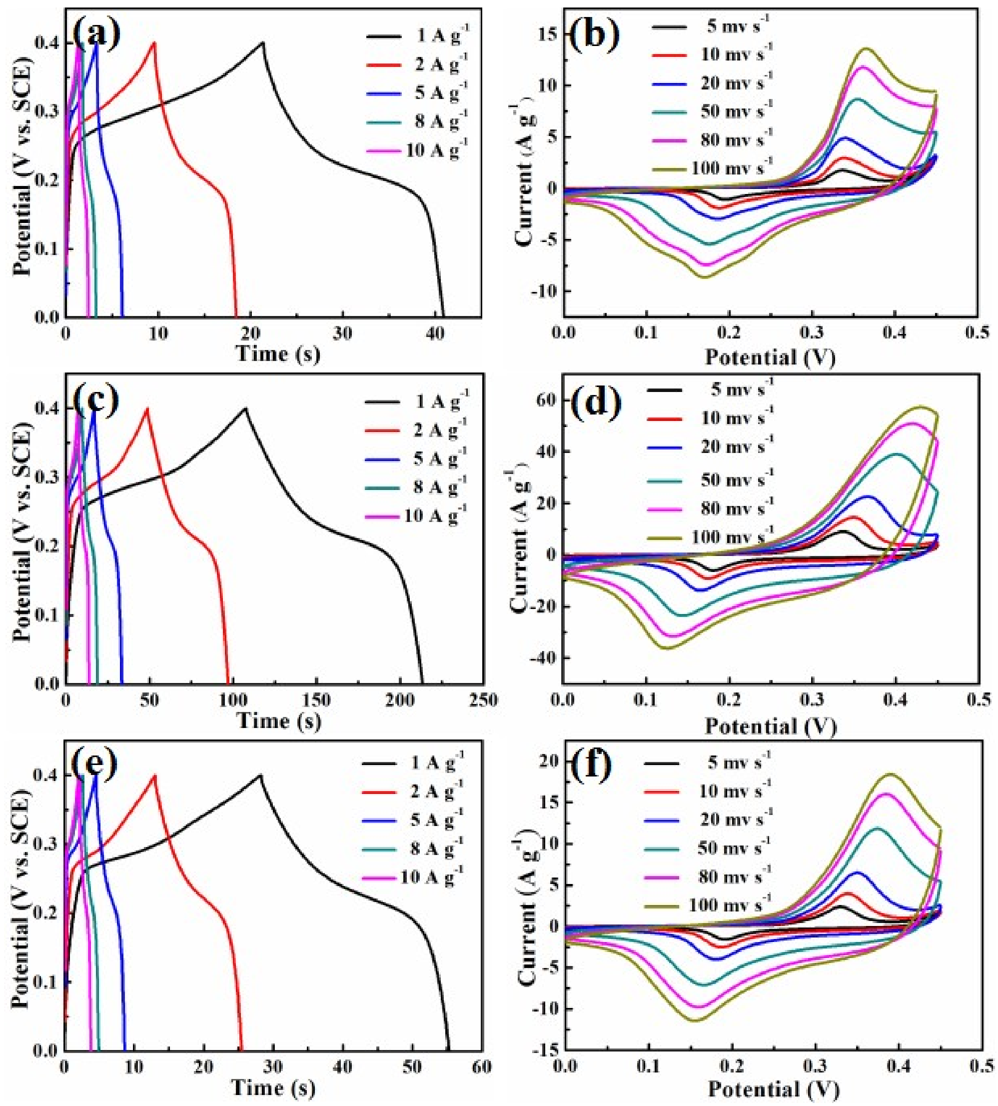


Fig. S5 GCD curves of Ni-MOF-X at various current densities and CV curves of Ni-MOF-X at various scan rates: (a, b) Ni-MOF-500, (c,d) Ni-MOF-600, (e, f) Ni-MOF-700.

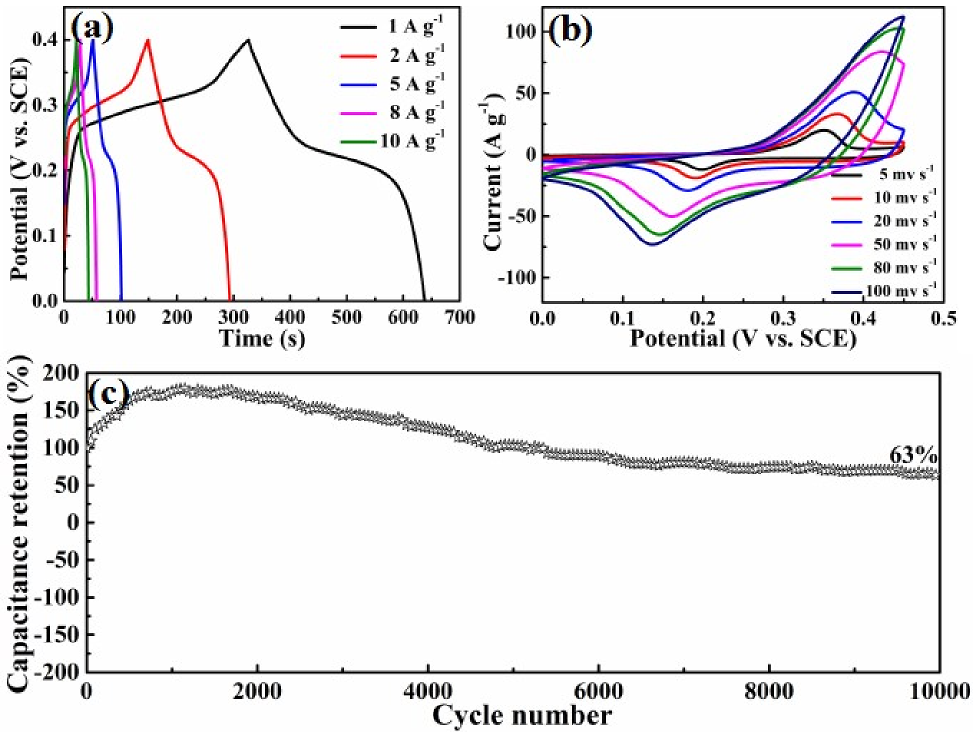


Fig. S6 (a) GCD curves of NiO/Ni/NCNTs at various current densities, (b) CV curves of NiO/Ni/NCNTs at various scan rates, (c) Cycling performance of NiO/Ni/NCNTs at a current density of 10 A g^{-1}.

Preparation of negative electrode and its electrochemical performances:

ZIF-67 materials were prepared by a simple reaction of 2-methylimidazole with cobalt ions and PVP. The details are given in the Experimental Methods section. The carbonization of ZIF-67 at 800 ^{o}C gives porous carbon, although it contains some Co nanoparticles, which can be removed by acid treatment. The SEM images of PC are shown in Fig. S7 a-b, we can see that the surface of porous carbon materials has large number of folds, which is conductive to the promotion of specific surface area. Therefore, we speculate that this porous carbon material will have good electrochemical performances.

The negative electrode for the asymmetric supercapacitor (ASC) was prepared by mixing ZiF-67 derived porous carbon (PC) , carbon black, polyvinylene difluoride (PVDF) (in the weight ratio of 8: 1: 1) together using NMP as solvent. The mixture was coated onto the cleaned Ni foam (1 cm^2) and was kept for drying at 80 °C overnight. Then the electrode was used as the working electrode. 3 M KOH solution, saturated calomel electrode (SCE) and platinum foil were used as the electrolytes, reference and counter electrodes, respectively. The PC electrode shows excellent electric double-layer capacitance property with a nearly rectangular shape (Fig. S7d). The specific capacitance of PC can be calculated from Fig. S7a and the value reach up to 183 F g^{-1} at 1 A g^{-1}. Meanwhile, the PC has the small charge transfer resistance and equivalent series resistance, which is beneficial to the effective transmission of electrons. (Fig. S7 c).

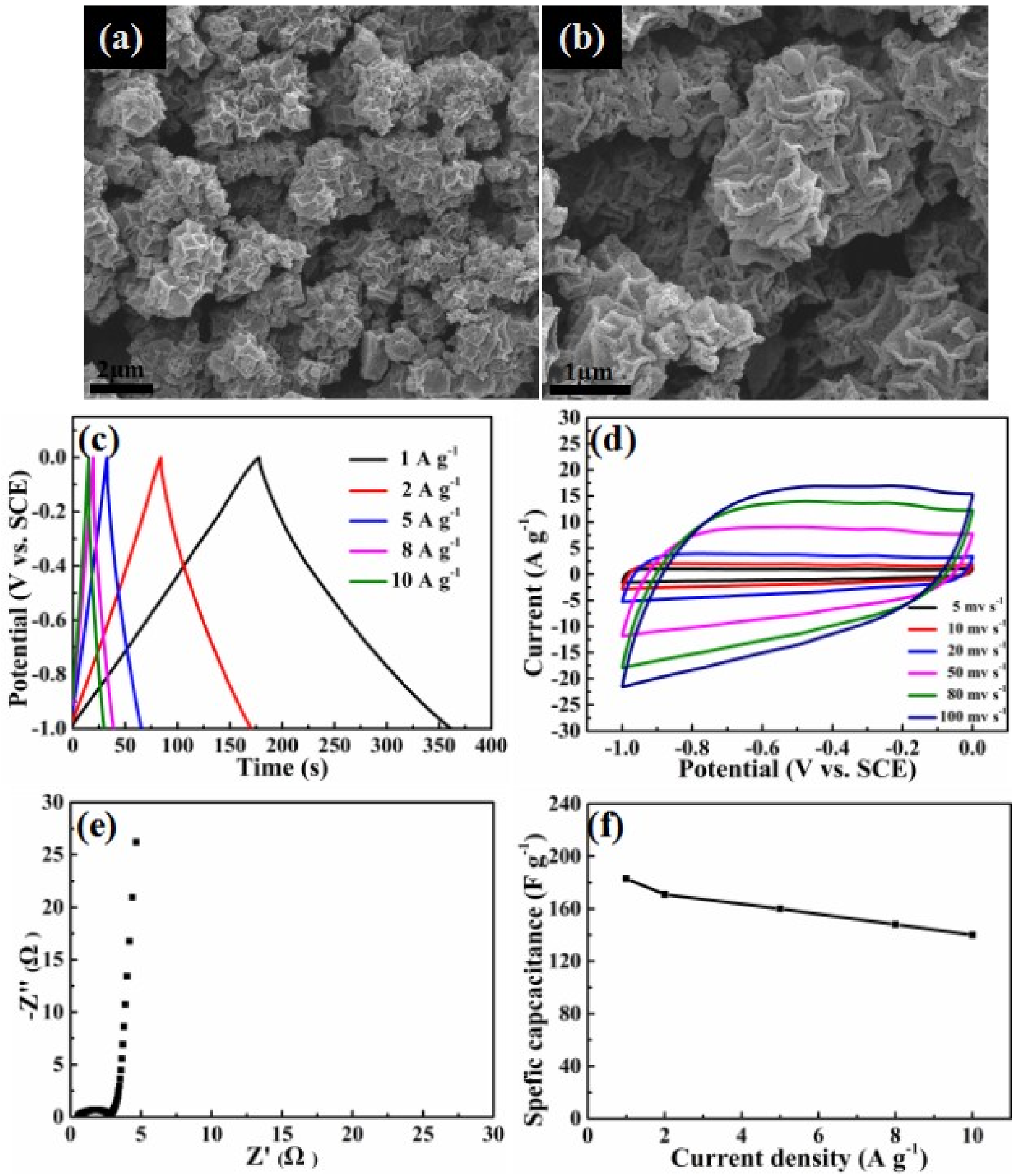


Fig. S7 (a, b) SEM images of porous carbon, (c) GCD curves of porous carbon at various current densities, (d) CV curves of porous carbon at various scan rates, (e) Nyquist plots of porous carbon, (f) Specific capacitance of porous carbon as a function of discharge current density.