Supporting Information

Scalable Synthesis of Nano-sandwich N-doped Carbon Materials with Hierarchical-structure for energy conversion and storage

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Table S1. Comparison of ORR performance in literature

Source/References	Solution	Loading (mg cm^{-2})	Activity (V vs. Ag/AgCl)
Our work (NNCM-1050-70)	PBS 50 mM	0.1	E_{onset} = 0.26
N-doped carbon nanofibers[1]	PBS 100 mM	0.14	E_{onset} = 0.12
Activated Carbon[2]	KCl 0.1 M	0.16	E_{onset} = 0.15
Activated Carbon[3]	PBS 100 mM	0.5	E_{onset} = 0.12
HP-Fe-N-Cs[4]	PBS 100 mM	0.15	E_{onset} = 0.197
BP-NF[5]	PBS 50 mM	0.1	E_{onset} = 0.2
N-Fe/Fe_3C@C[6]	PBS 100 mM	0.5	Eonset = 0.21

Table S2. Comparison of supercapacitor performance in our work and some references

Source/References	Electrolyte	Current density	Capacitance(F g^{-1})
Our work (NNCM-900-70)	6 M KOH	1 A g^{-1} 8 A g^{-1}	178 121
RGO[7]	6 M KOH	1 A g^{-1}	190
Graphene[8]	5 M KOH	0.1 A g^{-1}	155
r[GO-CNT][9]	1 M $TEABF_4$	1 A g^{-1}	109.1
Graphene[10]	0.5 M NaCl	0.6 A g^{-1}	230
N-doped carbon fibers[11]	6 M KOH	1 A g^{-1}	202
Co_3O_4/r-GO[12]	6 M KOH	1 A g^{-1}	163.8

Performance of gas storage

Considering the tunable pore size, heteroatom doping and high specific surface area in NNCMs, especially the NNCMs-1050-70, and the energy gas molecules, such as the hydrogen and acetylene, uptake were measured. Hydrogen adsorption isotherms of those carbon materials from 0-1 atm at 77 K by the volumetric method are shown in Figure S1. The hydrogen uptakes of NNCM-1050-70 were 1.74 wt% at 1 atm, which is comparable with best activated carbon (about 1.8 %) as reported previously.[13] This excellent performance may be resulted from the synergetic effect of the high specific surface are, suitable pore size and the N-doping in the carbon nanomaterials. In practice, C_2H_2 gas is stored at ambient temperatures. The C_2H_2 adsorption experiment was carried out at room temperature (295 K) under 1 atm. The C_2H_2 adsorption amount for NNCM-1050-70 reaches up to 75 cm^3(STP) g^{-1} at 295 K and 1 atm, near to the highest record of pores space adsorption 113 cm^3 (STP) g^{-1}.[14] The tunable pore size, heteroatom doping and high specific surface area of the NNCMs may be responsible for C_2H_2 storage. In conclusion, the obtained NNCMs with hierarchical structure can be used as a potential candidate for the renewable energy gas storage.

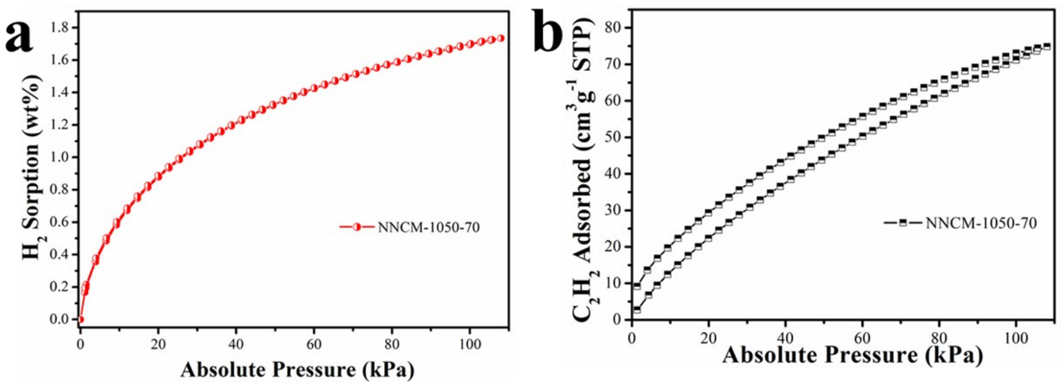

Figure S1. (a) Hydrogen adsorption isotherms of NNCM-1050-70 from 0 to 1 atm at 77 K by the volumetric method. (b) C_2H_2 adsorption of NNCM-1050-70 from 0 to 1 atm at 295 K.

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