Supporting Information

Templated and Catalytic Fabrication of N-doped Hierarchical Porous Carbon-Carbon Nanotubes Hybrids as Host for Lithium–Sulfur Batteries

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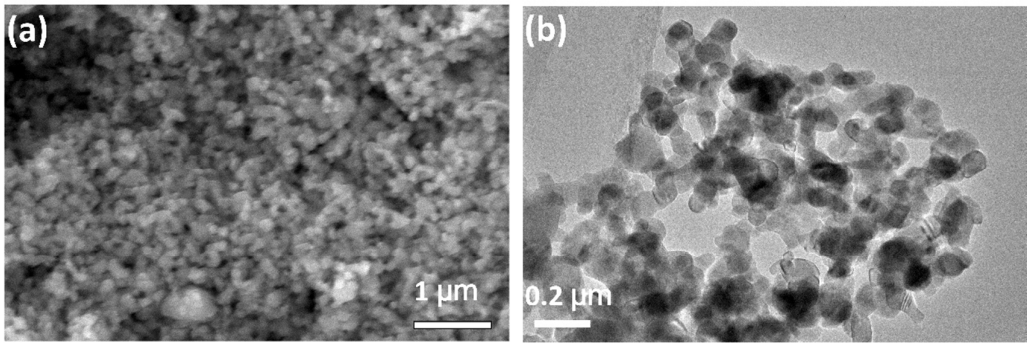

Figure S1. SEM (a) and TEM (b) images of nano-$CaCO_3$.

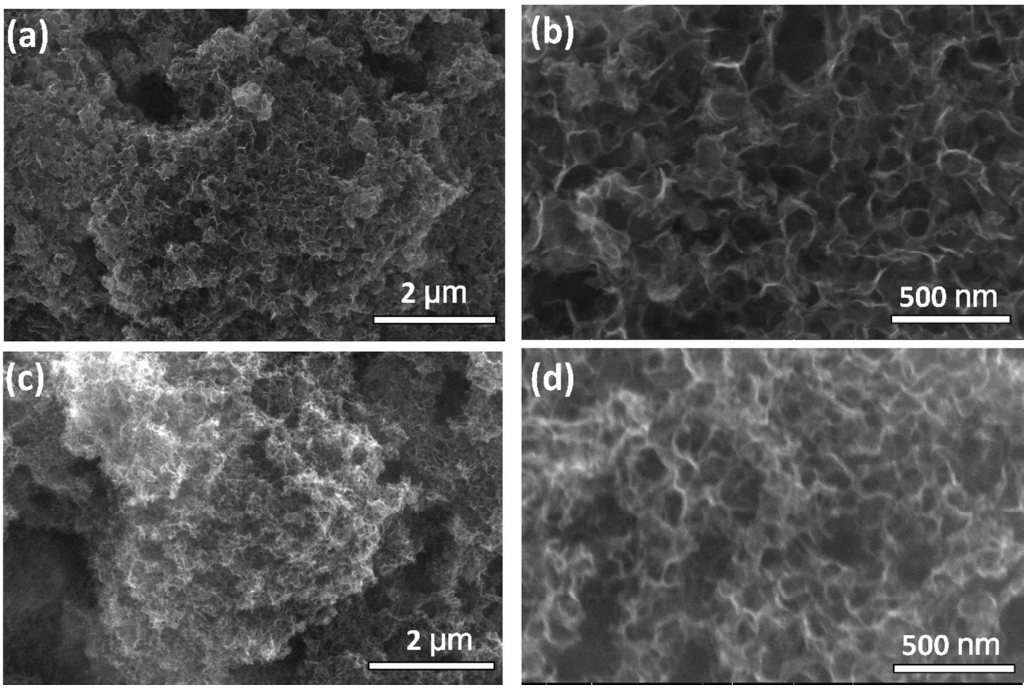

Figure S2. SEM images of N-HPC synthesized with different amount of nano-$CaCO_3$: (a-b) 4.5g; and (c-d) 7.5g.

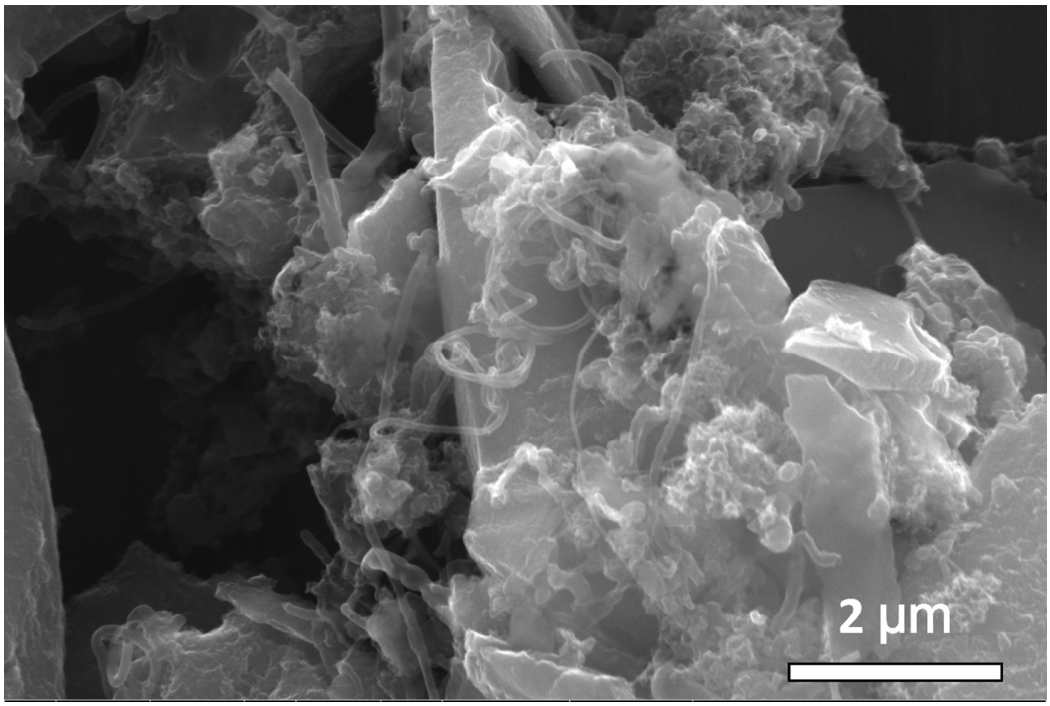

Figure S3. SEM images of N-HPC-CNTs synthesized without nano-$CaCO_3$.

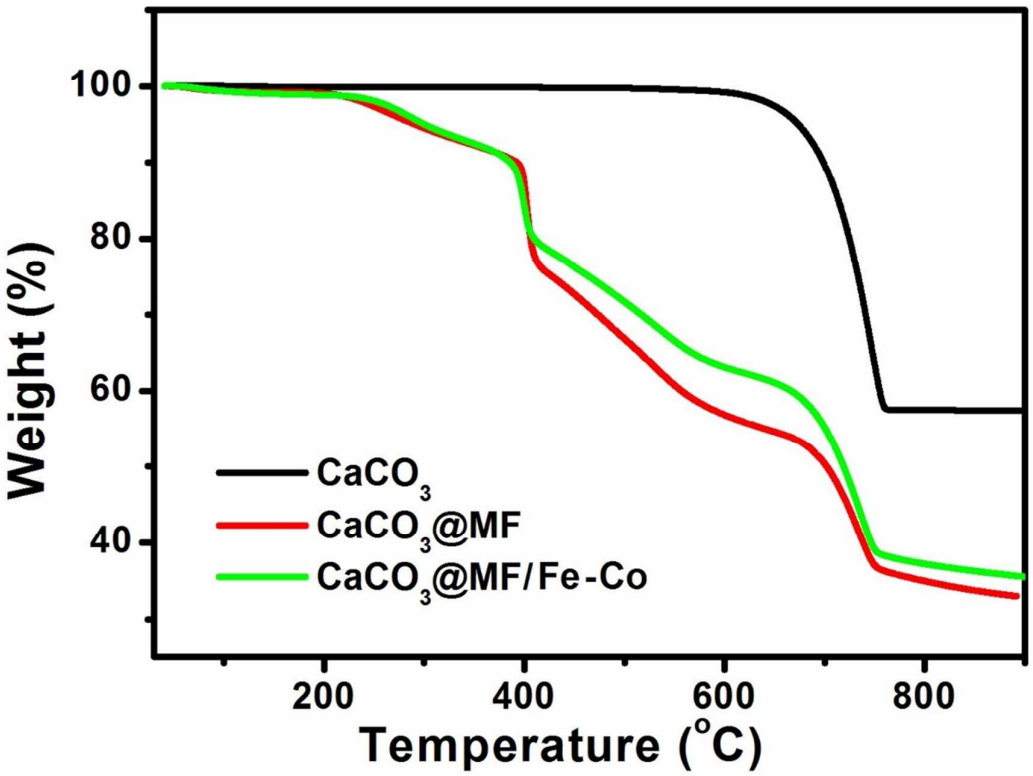

Figure S4. TGA curves of $CaCO_3$, $CaCO_3$@MF and $CaCO_3$@MF/Fe-Co under argon atmosphere.

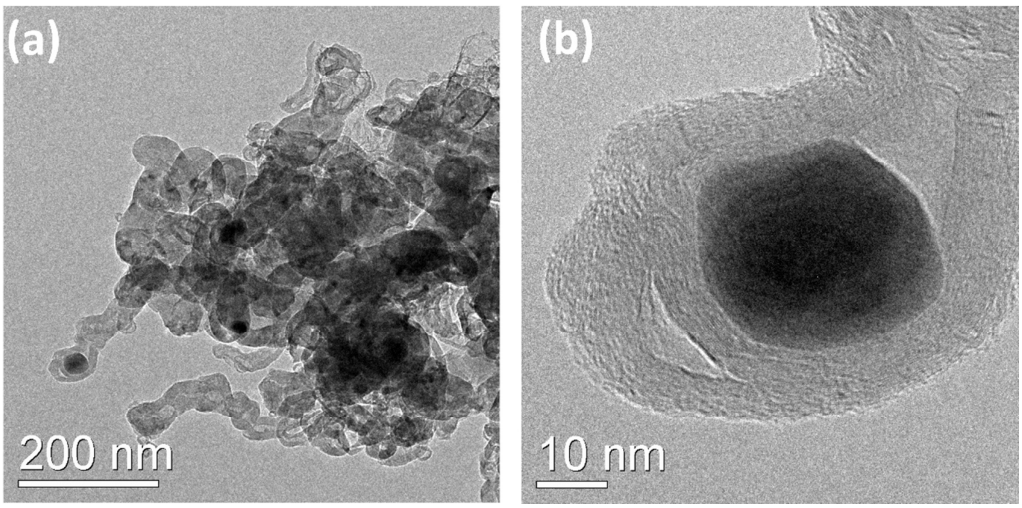

Figure S5. SEM image of N-HPC-CNTs that metal catalyst encapsulated in the tip of CNT (a-b).

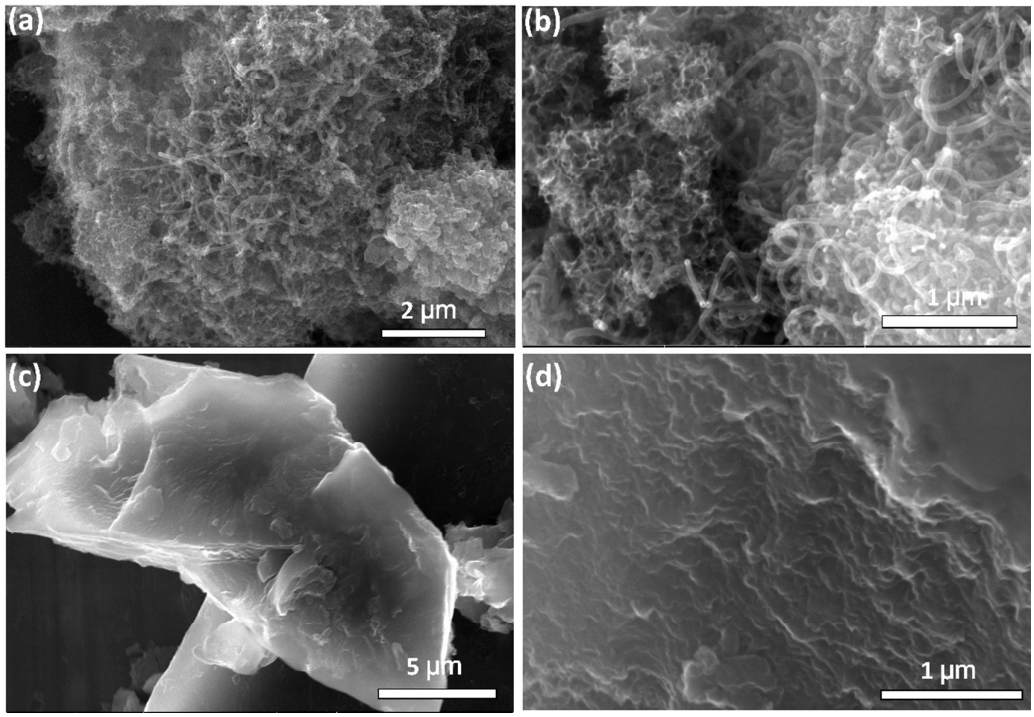

Figure S6. SEM image of SEM images of (a-b) N-HPC-CNTs hybrids (60 mg of catalyst) with exposed HPC; (c-d) N-HPC prepared at 700 □.

	$CaCO_3$ (g)	Fe-Co (mg)	S_{BET} (m^2 g^{-1})	V_{total} (cm^3 g^{-1})
N-HPC	4.5	0	320	0.94
	6.5	0	687	1.64
	7.5	0	561	1.31
N-HPC-CNTs	6.5	20	587	1.05
	6.5	60	651	1.19
	6.5	100	593	1.06

Table S1. BET surface areas and pore volume of different samples.

	$CaCO_3$ (g)	Fe-Co (mg)	C (wt.%)	N (wt.%)	O (wt.%)
N-HPC	4.5	0	89.7	7.4	2.9
	6.5	0	90.0	5.3	4.6
	7.5	0	93.2	2.9	2.7
N-HPC-CNTs	6.5	20	94.7	2.3	3.1
	6.5	60	94.9	1.7	3.4
	6.5	100	95.4	1.2	3.4

Table S2. Element compositions determined by XPS.

	Pyridinic-N (%)	Pyrrolic-N (%)	Graphitic-N (%)	Oxidized pyridinic-N (%)
N-HPC	28.3	23.8	36.3	11.6
N-HPC-CNTs	14.6	7.7	53.1	24.6

Table S3. The integral area and fractions of different nitrogen species derived from figure 5d.

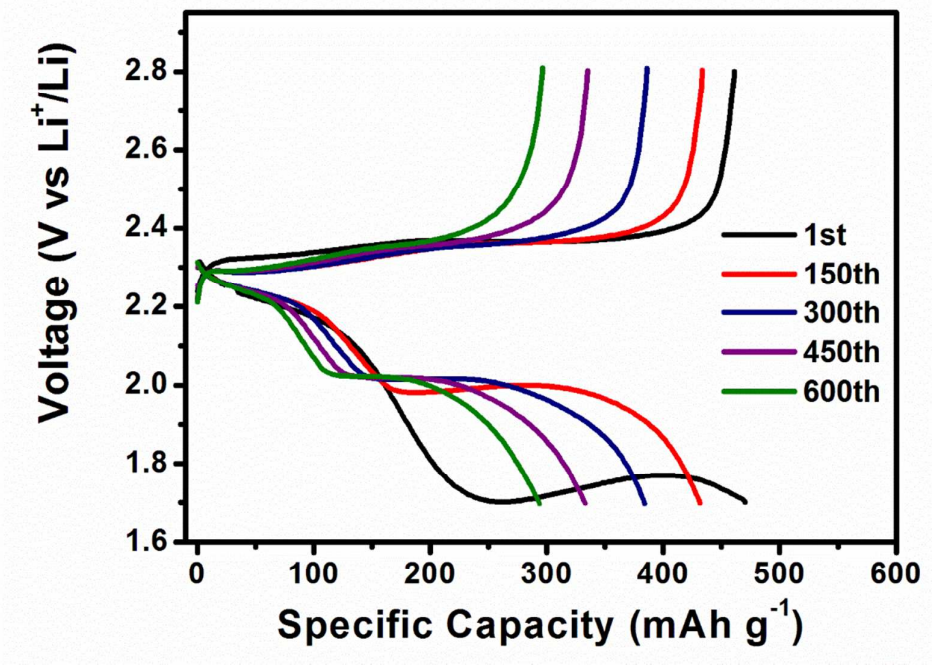

Figure S7. Galvanostatic charge/discharge curves of N-HPC-CNTs/S with 76.4 wt%.

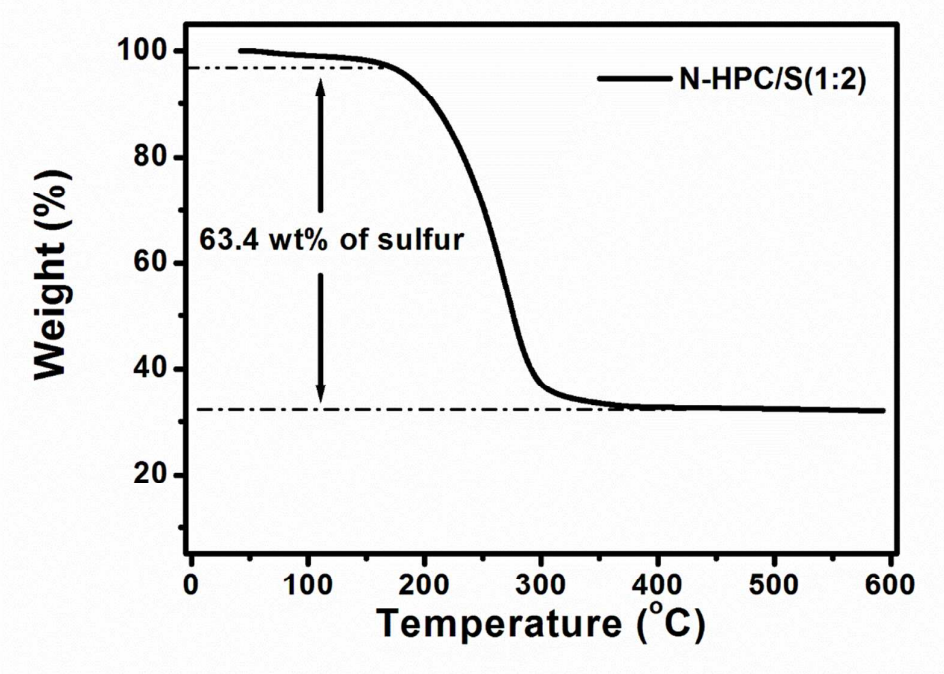

Figure S8. TGA curves of N-HPC/S cathode prepared by using mass ratio of carbon to sulfur is 1:2.

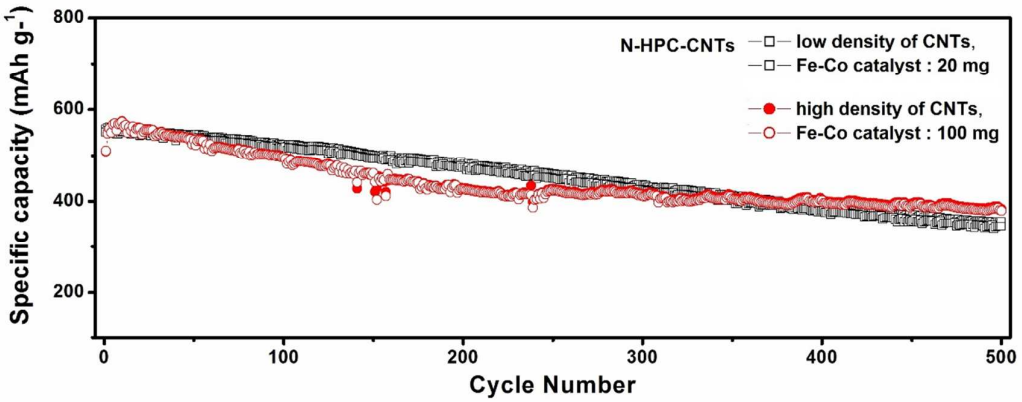

Figure S9. Cycling performance of N-HPC-CNTs/S (1:2) samples with low density (prepared by 20 mg of catalyst) and high density (prepared by 100 mg of catalyst) of CNTs.

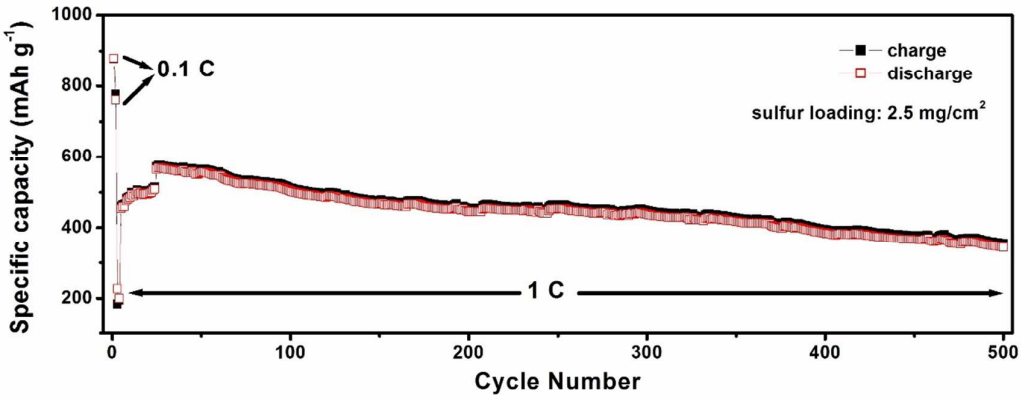

Figure S10. Long-term cycling performance of the N-HPC-CNTs/S with 62.8 wt% and the sulfur loading of the electrode is approximately 2.5 mg/cm^2.

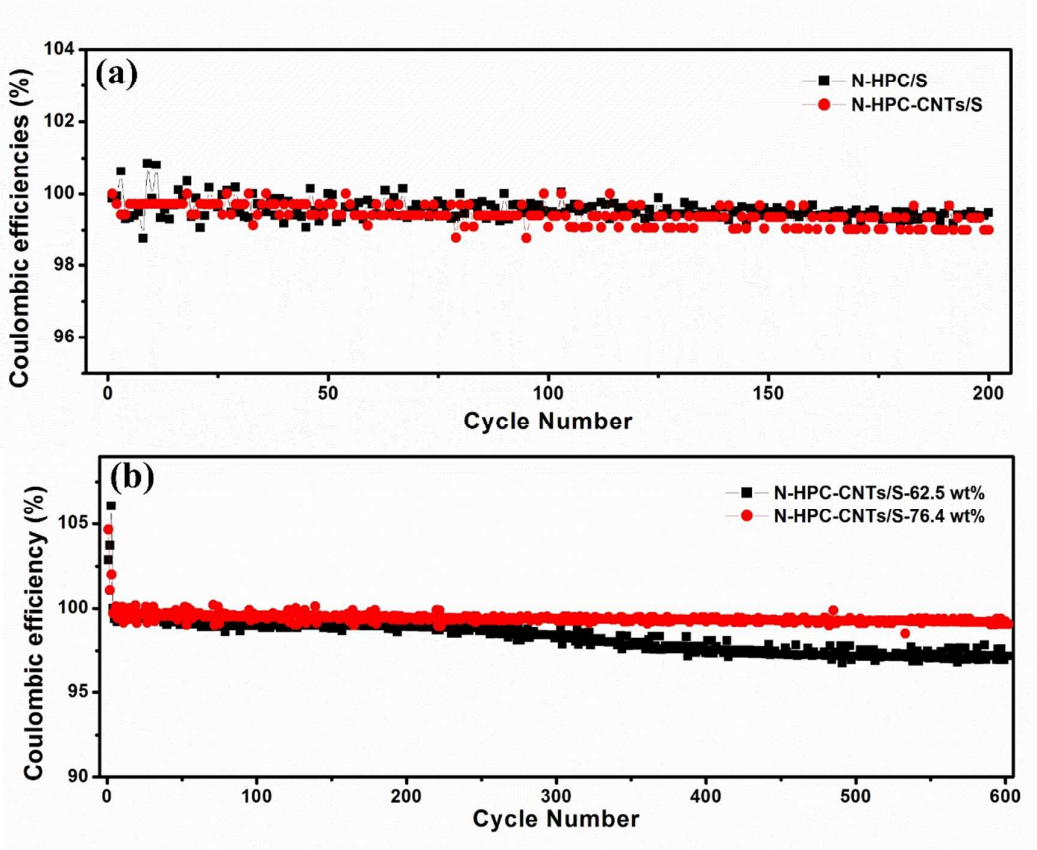

Figure S11. Coulombic efficiencies of (a) N-HPC/S and N-HPC-CNTs/S prepared by a same mass ratio of carbon to sulfur (1:2) at a current rate of 0.5 C; (b) N-HPC-CNTs/S with 62.8 wt% and 76.4 wt% sulfur content at a current density of 1 C.

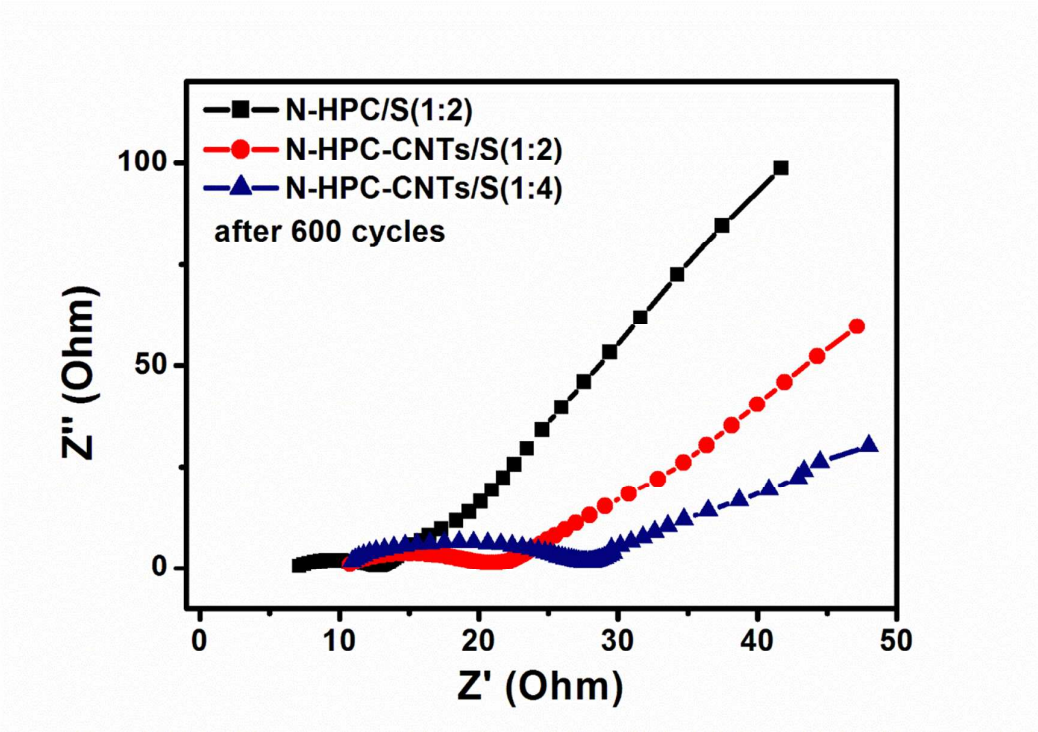

Figure S12. Nyquist plots from EIS of three samples after 600 cycles.