Supplementary Materials

A High Strength, Free-Standing Cathode Constructed by Regulating Graphitization and Pore Structure in Nitrogen-Doped Carbon Nanofibers for Flexible Lithium-Sulfur Battery

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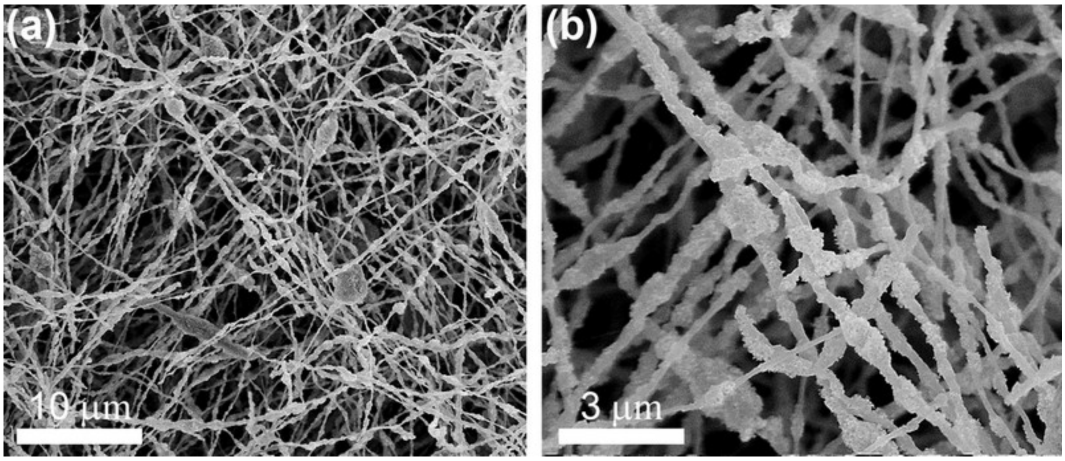

Fig. S1 SEM images of SiO_2/G/NPCFs with SiO_2 concentration of 30 mg mL^{-1}.

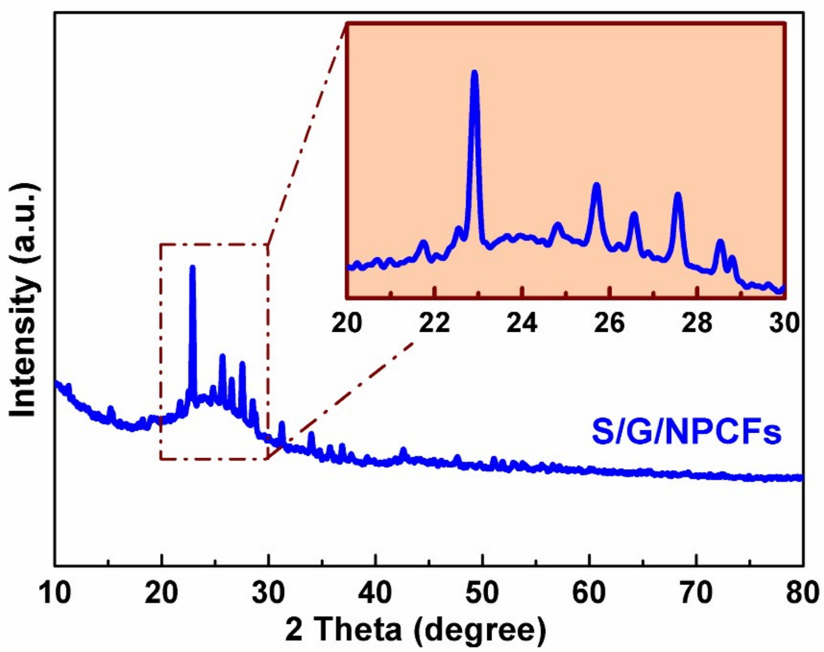

Fig. S2 XRD diffraction pattern of S/G/NPCFs (inset: partial enlarge pattern of S/G/NPCFs).

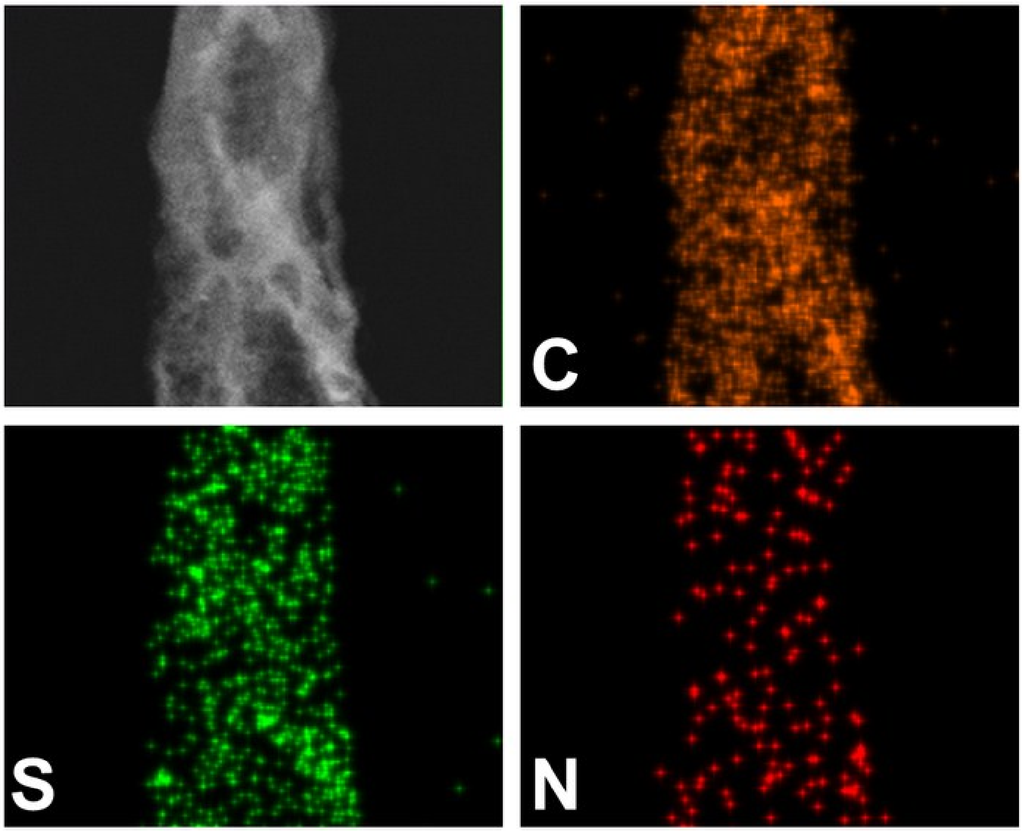

Fig. S3 Elemental mapping of S/G/NPCFs.

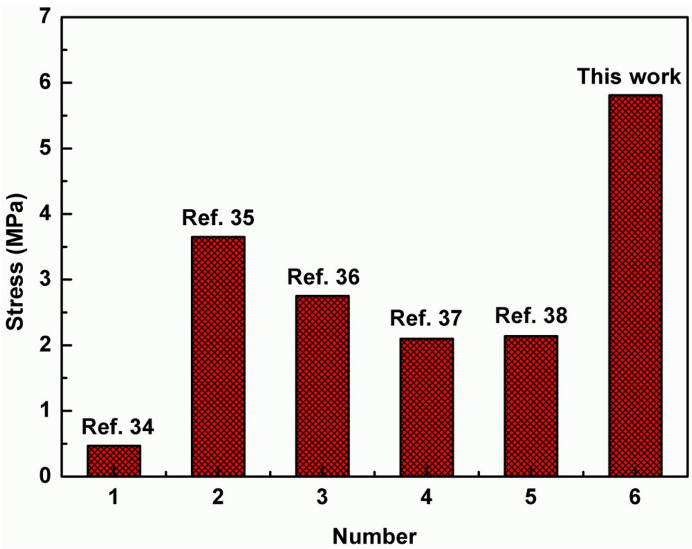

Fig. S4 Mechanical strength comparisons of this work with some other flexible S/C cathodes.

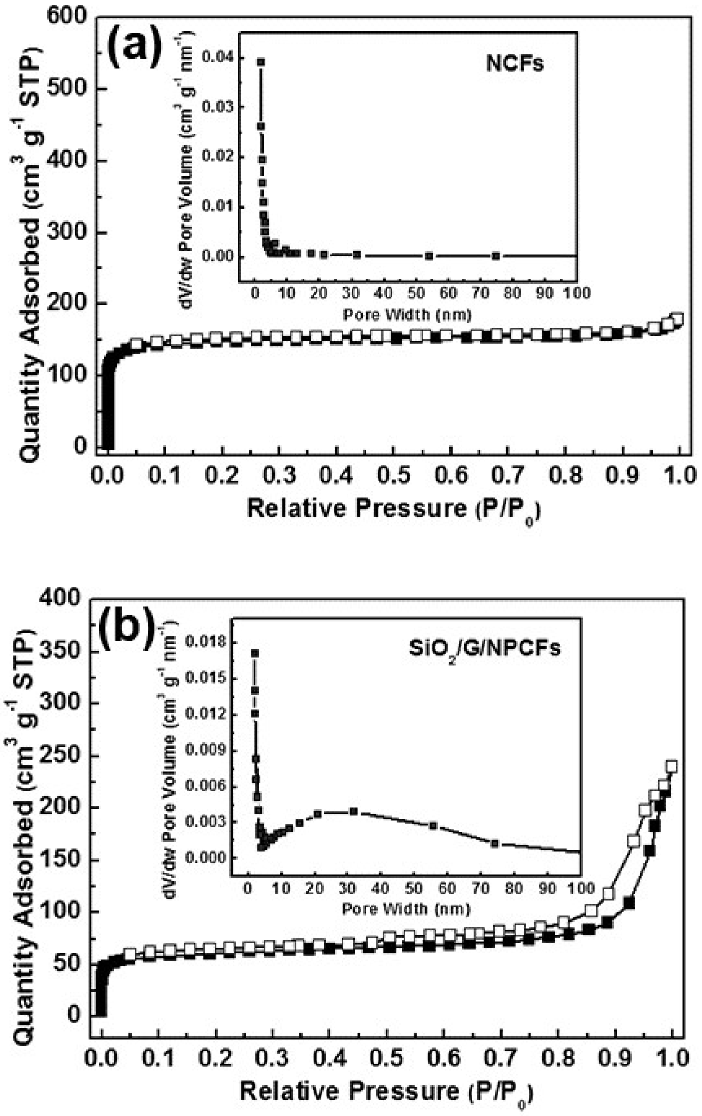

Fig. S5 a) Nitrogen adsorption-desorption isotherms of NCFs and b) SiO_2/G/NPCFs (insets are the corresponding pore size distribution curves).

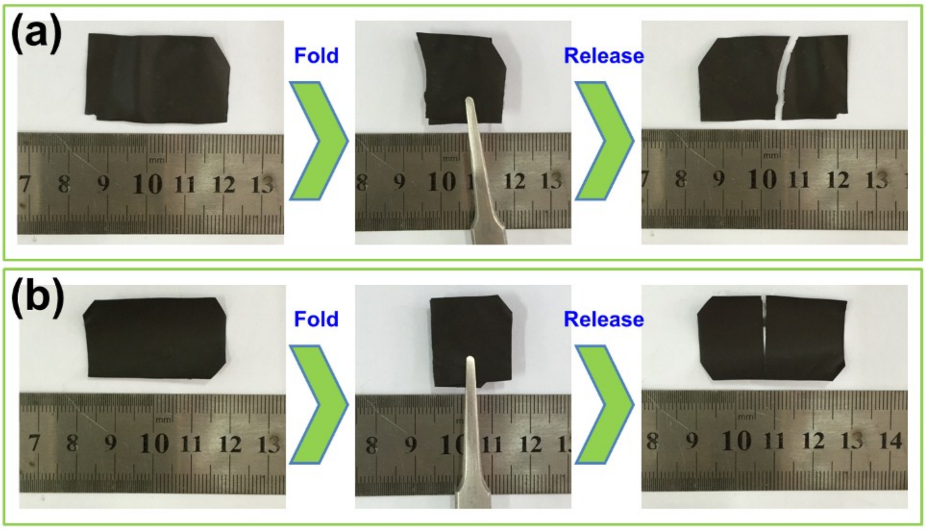

Fig. S6 Mechanical properties of sulfur composite film without adding SiO_2. a) Photographs of S/NCFs composite film and b) S/G/NCFs composite film.

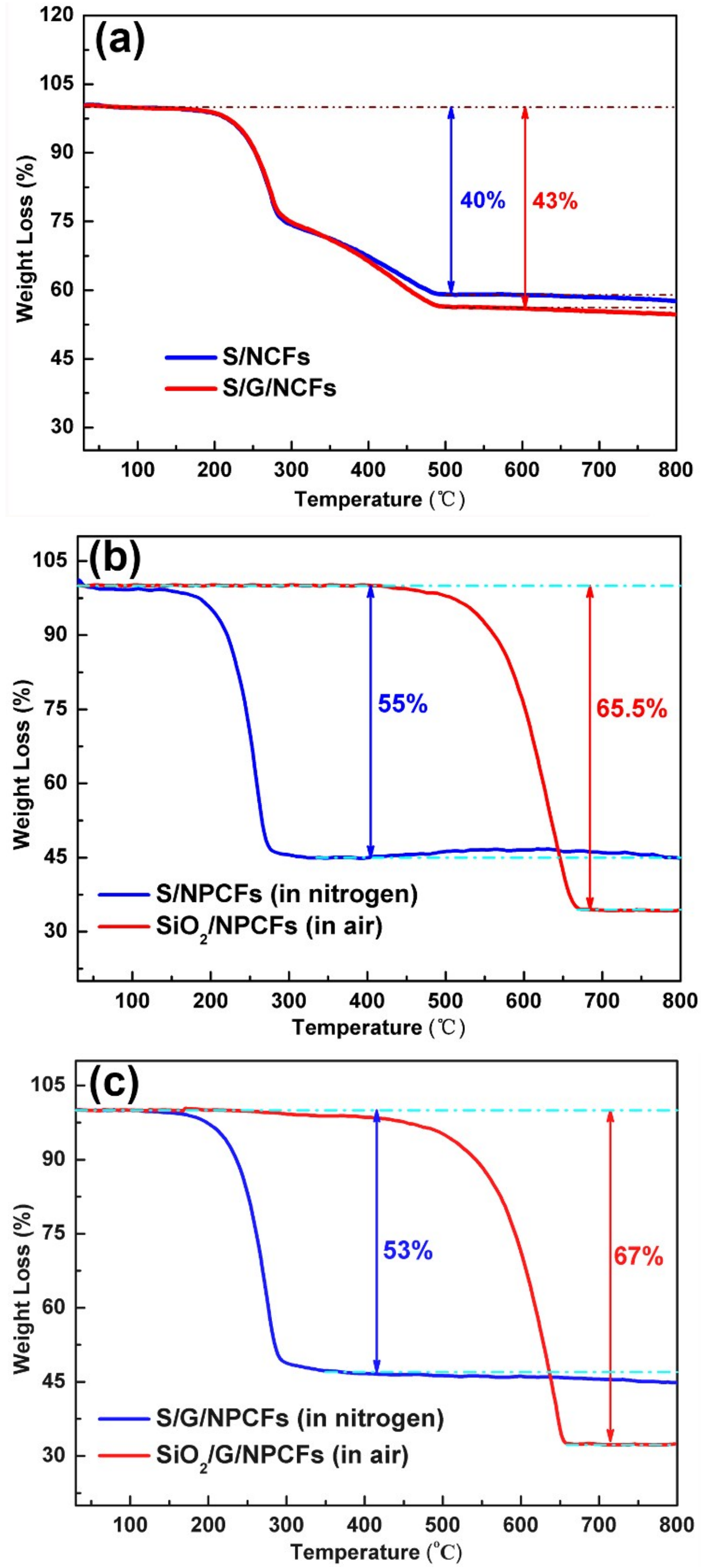

Fig. S7 a) TG curves of S/NCFs (in nitrogen) and S/G/NCFs (in nitrogen); b) TG curves of SiO_2/NPCFs (in air) and S/NPCFs (in nitrogen); c) TG curves of SiO_2/G/NPCFs (in air) and S/G/NPCFs (in nitrogen).

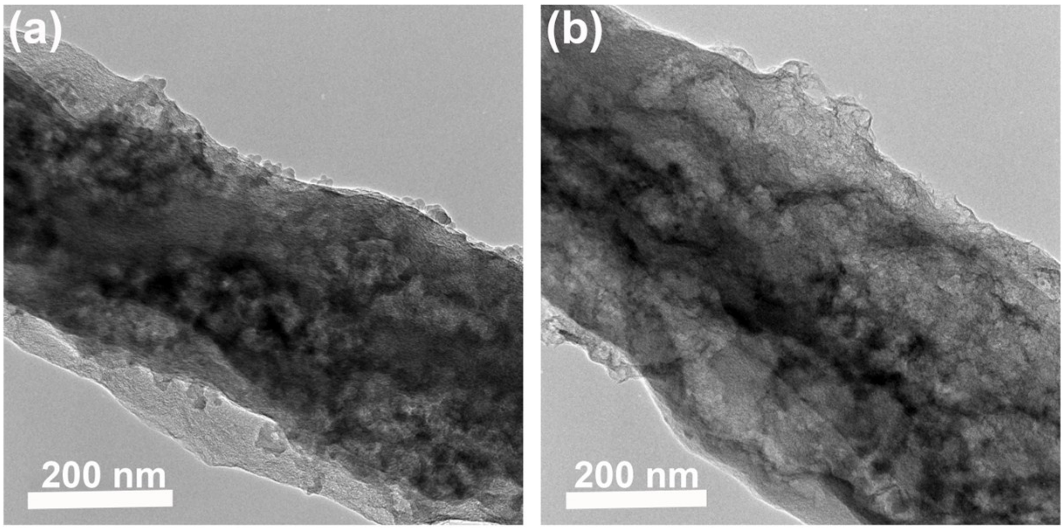

Fig. S8 TEM images of a) SiO_2/G/NPCFs, b) G/NPCFs;

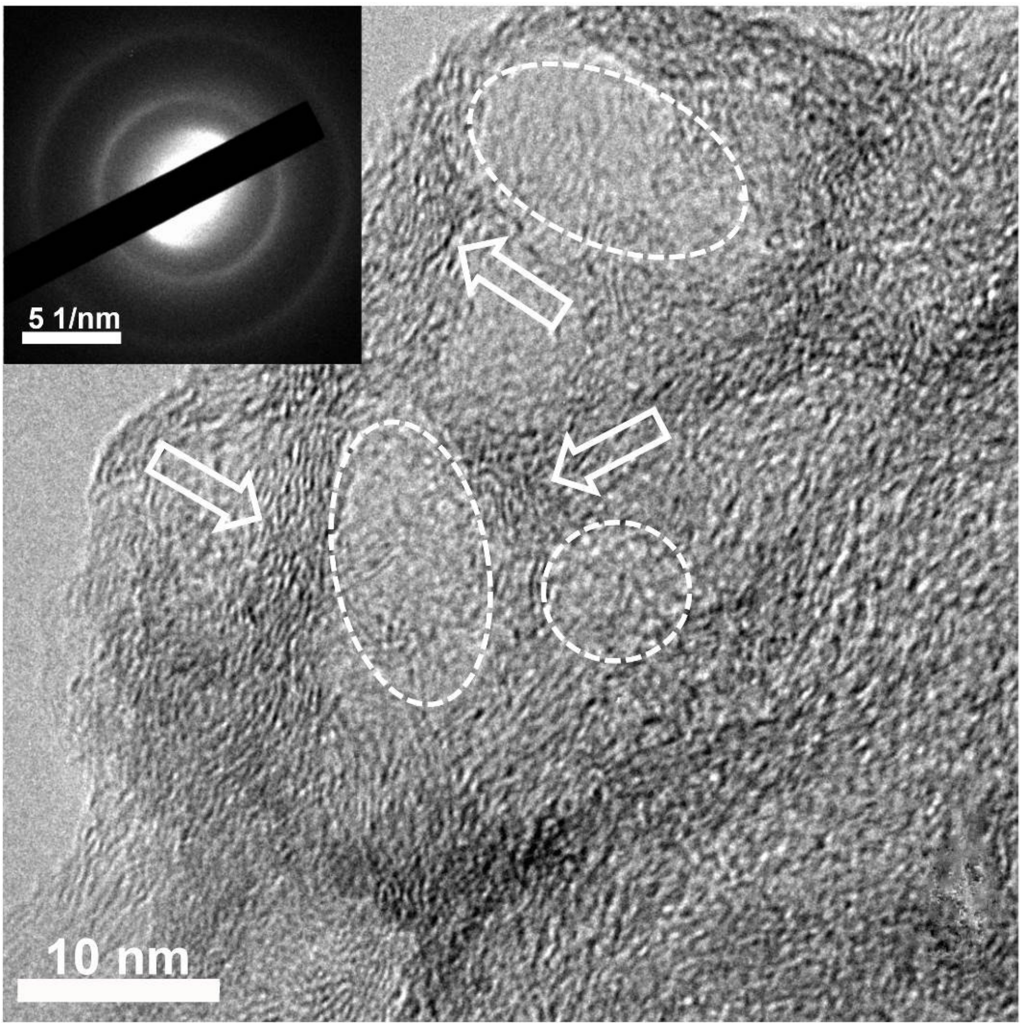

Fig. S9 HRTEM of G/NPCFs (inset is the SAED pattern).

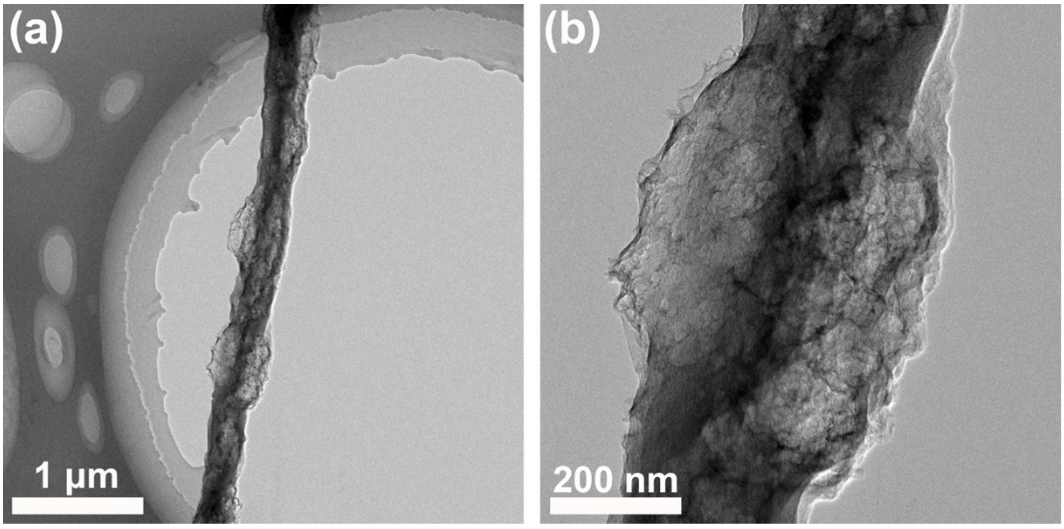

Fig. S10 TEM images of NPCFs.

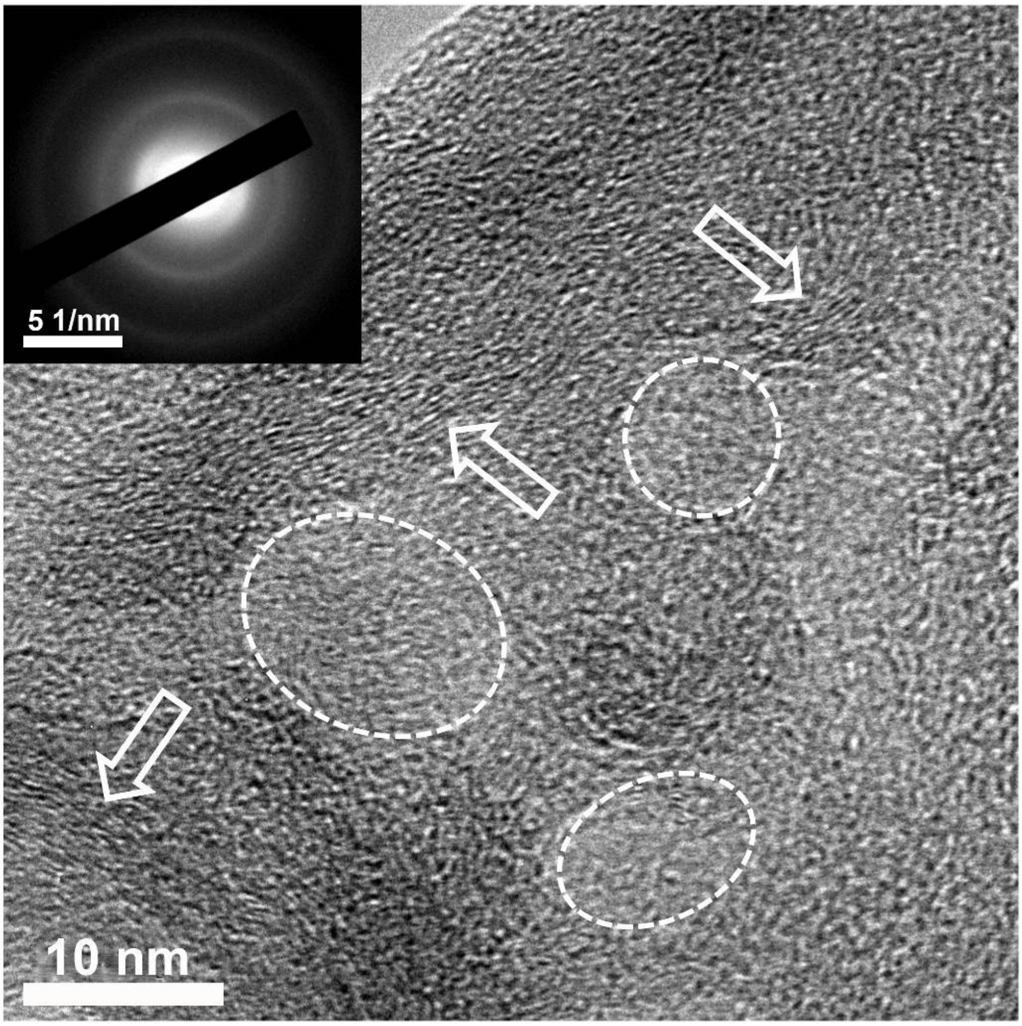

Fig. S11 HRTEM image of NPCFs (inset is the SAED pattern).

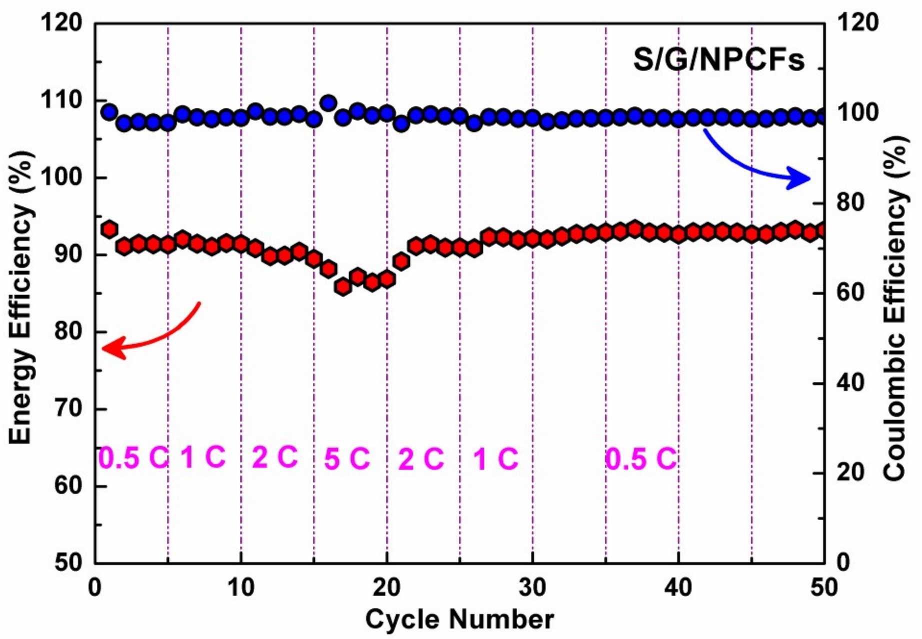

Fig. S12 Energy efficiency and Coulombic efficiency of S/G/NPCFs electrode at different current densities.

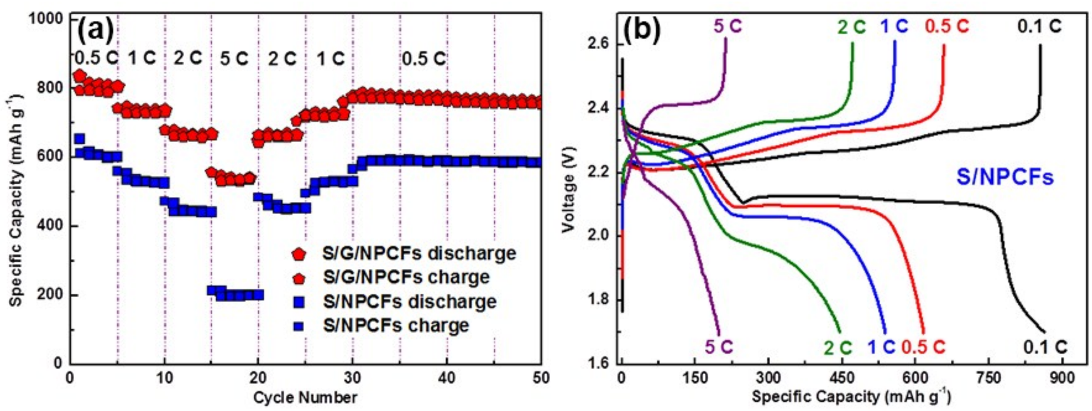

Fig. S13 a) Rate capabilities of S/NPCFs and S/G/NPCFs electrode; b) Typical discharge-charge curves of S/NPCFs electrodes recorded at current rates of 0.1 C, 0.5 C, 1 C, 2 C, and 5 C.

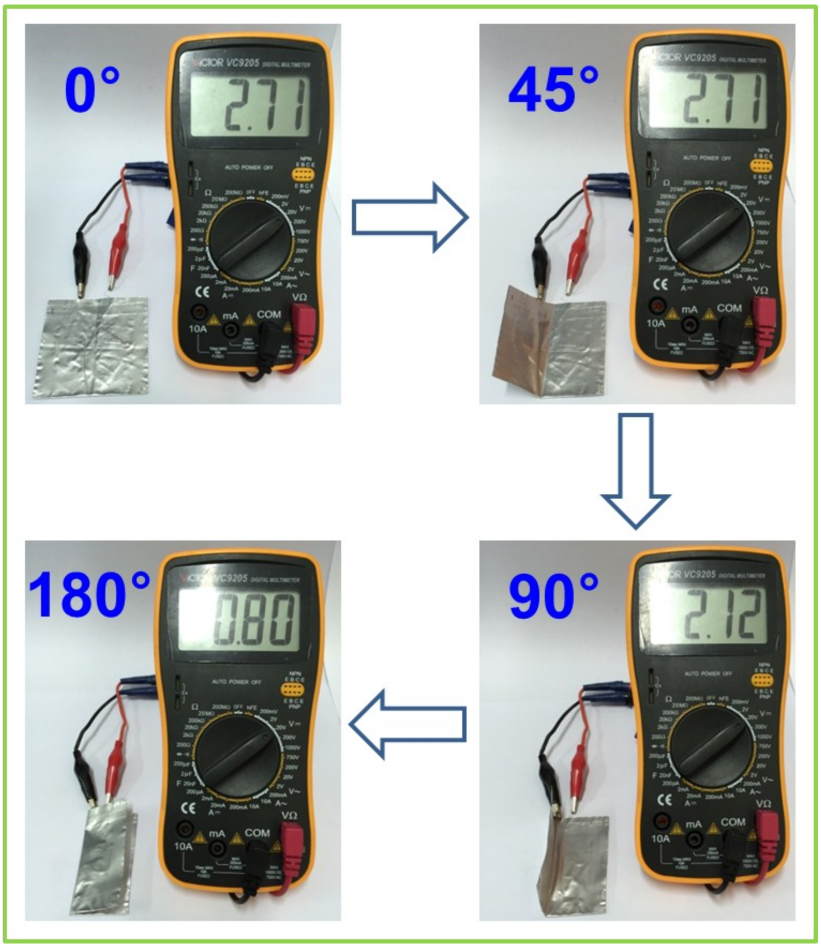

Fig. S14 The open-circuit voltage of a flexible battery using S/G/NCFs electrode as cathode at different bending angles.

Table S1. The detail information of the as-prepared samples' abbreviations.

	Precursor	Carbonization	Etch	Sulfurization
With adding GO and SiO_2	**SiO_2/GO/PAN**	**SiO_2/G/NPCFs**	**G/NPCFs**	**S/G/NPCFs**
With adding SiO_2	**--**	**--**	**NPCFs**	**S/NPCFs**
Without adding GO and SiO_2	**--**	**--**	**NCFs**	**S/NCFs**
Without adding SiO_2	**--**	**--**	**G/NCFs**	**S/G/NCFs**

Table S2. Textural parameters of NCFs, SiO_2/G/NPCFs, G/NPCFs, S/G/NPCFs.

Sample	BET surface area(m^2 g^{-1})	Total pore volume(cm^3 g^{-1})	Micropore volume(cm^3 g^{-1})
NCFs	577	0.277	0.227
SiO_2/G/NPCFs	232	0.371	0.093
G/NPCFs	429	0.522	0.173
S/G/NPCFs	14	0.095	0.005

Table S3. Comparison of rate capabilities of representative S cathode materials in the literature.

Material	Sulfur Loading	Rate capability
S/G/NPCFs *This work*	53 wt.% (flexible)	815 mAh g^{-1} at 0.5 C 735 mAh g^{-1} at 1 C 670 mAh g^{-1} at 2 C 540 mAh g^{-1} at 5 C (1 C = 1675 mA g^{-1})
graphene/sulfur *Ref. S1*	66.7 wt% (flexible)	1500 mAh g^{-1}at ~0.03 C 750 mAh g^{-1}at ~0.5 C 500 mAh g^{-1}at ~1 C
CNF/sulfur *Ref. S2*	40 wt% (N/A)	645 mAh g^{-1}at ~0.06 C 437 mAh g^{-1} at ~0.6 C
Cu-CNF/sulfur *Ref. S3*	52 wt% (N/A)	590 mAh g^{-1} at ~0.06 C 419 mAh g^{-1} at ~0.6 C
Graphene/N-doped Hollow Carbon	~55 wt% (flexible)	800 mAh g^{-1}at 1C 600 mAh g^{-1}at 2C

Nanosphere/sulfur *Ref. S4*		430 mAh g^{-1}at 3C
Polysulfides/CNT/AC NF@MnO2 *Ref. S5*	55 wt% (flexible)	1045mAh g^{-1} at 0.2 C 955 mAh g^{-1} at 0.5 C 878 mAh g^{-1} at 1 C 773 mAh g^{-1} at 2 C
S/Bilayer Carbon *Ref. S6*	< 40 wt% (N/A)	1078 mAh g^{-1} at 0.2 C 964 mAh g^{-1} at 0.5 C 890 mAh g^{-1} at 1 C 720 mAh g^{-1} at 2 C 685 mAh g^{-1} at 3 C
S/CNT Network *Ref. S7*	60 wt% (N/A)	656 mAh g^{-1} at 0.4 C 571 mAh g^{-1} at 0.8 C 541 mAh g^{-1} at 1 C 503 mAh g^{-1} at 2 C 452 mAh g^{-1} at 5 C
Amine-functionalized Carbon Nanotube *Ref. S8*	70 wt% (56 wt% in the electrode)	~950 mAh g^{-1} at 0.5 C ~890 mAh g^{-1} at 1 C ~650 mAh g^{-1} at 2 C ~300 mAh g^{-1} at 4 C
S/ hierarchical Microporous- mesoporous Carbonaceous Nanotubes *Ref. S9*	50.5 wt% (42.9 wt% in the electrode)	813 mAh g^{-1} at ~0.5 C 662 mAh g^{-1} at ~1 C 491 mAh g^{-1} at ~2 C

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