Electronic Supplementary Material (ESI) for Nanoscale

Supplementary Information for

A Dual Coaxial Nanocable Sulfur Composite for High-Rate Lithium-Sulfur Batteries

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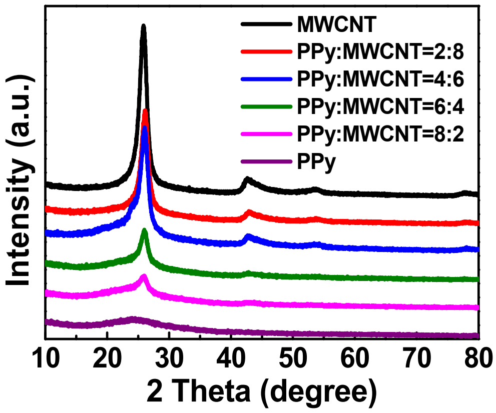

Fig. S1 XRD patterns of pure MWCNT, PPy : MWCNT = 2 : 8, PPy : MWCNT = 4 : 6, PPy : MWCNT = 6 : 4, PPy : MWCNT = 8 : 2 and pure PPy.

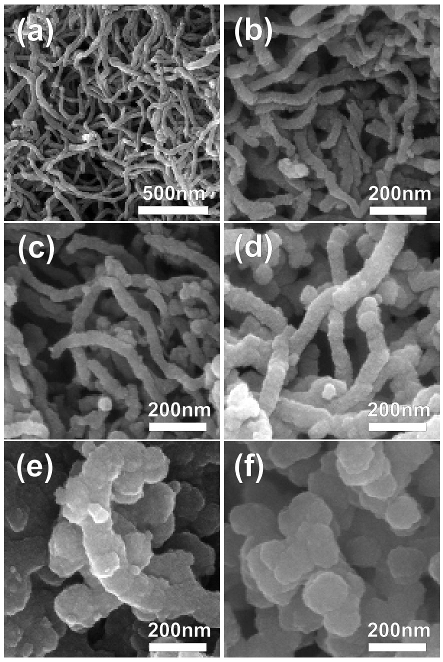

Fig. S2 SEM images for (a) pure MWCNT, (b) PPy : MWCNT = 2 : 8, (c) PPy : MWCNT = 4 : 6, (d) PPy : MWCNT = 6 : 4, (e) PPy : MWCNT = 8 : 2, and (f) pure PPy.

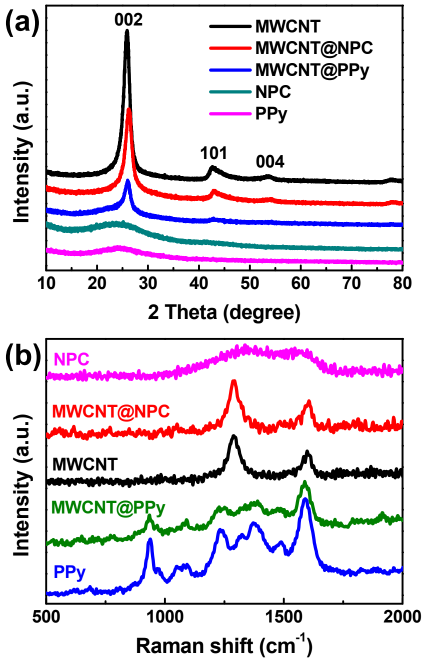

Fig. S3. (a) XRD patterns and (b) Raman patterns for MWCNT, PPy, MWCNT@PPy and MWCNT@NPC.

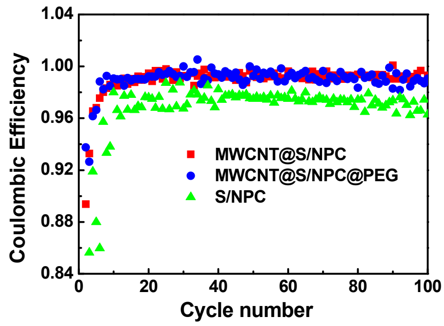

Fig. S4 The Coulombic efficiencies of S/NPC, MWCNT@S/NPC, MWCNT@S/NPC@PEG cycled at 1 C in the voltage range of 2.8 – 1.8 V *vs* Li^+/Li.

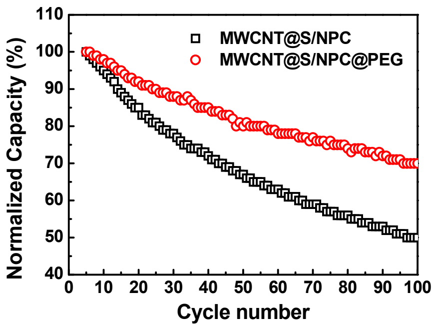

Fig. S5 Normalized discharge capacity of MWCNT@S/NPC and MWCNT@S/NPC@PEG.

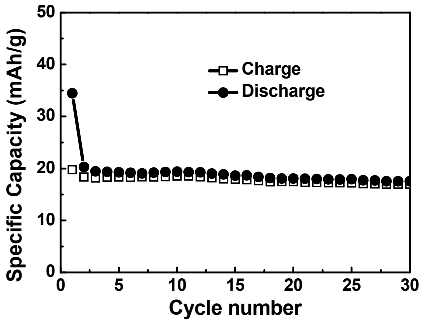

Fig. S6 The capacity of pure MWCNT@NPC at 168 mA g^{-1} in the range of 2.8 – 1.8 V *vs* Li^+/Li.

Fig. S6 shows the capacity over cycling for pure MWCNT@NPC carbon in the range of 2.8 – 1.8 V *vs* Li^+/Li. The capacity of carbon was only 20 mAh g^{-1}, which was only ~ 2% of that of sulfur. So, it can be concluded that the carbon matrix has almost no contribution to the sulfur/carbon composites.

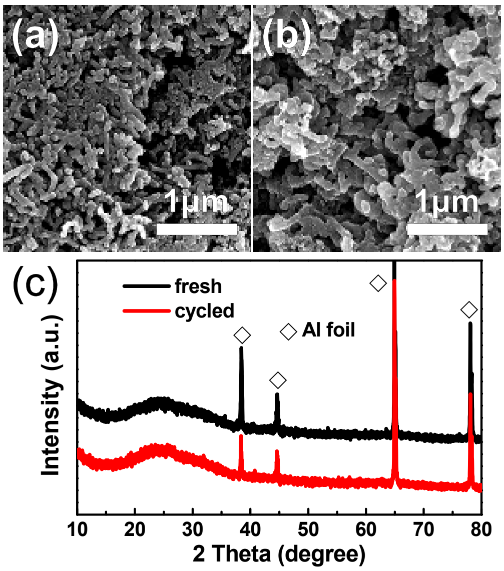

Fig. S7 SEM images of fresh (a) and cycled (b) electrode films of MWCNT@S/NPC@PEG; (c) XRD patterns comparison of fresh and cycled electrode films of MWCNT@S/NPC@PEG.

The SEM images in Fig. S7a, b prove the structural stability of the MWCNT@S/NPC@PEG composite. Moreover, the cross-linked nanotube provides excellent conducting webs for both electrons and lithium ions. The XRD patterns in Fig. S4c indicate the phase stability of the MWCNT@S/NPC@PEG composite during cycle.

Table S1 The comparison of this work with some other similar composites.

Composites	Sulfur content (wt%)	Specific capacity ($mAh\ g^{-1}$)						Cycle performance ($mAh\ g^{-1}$)	Ref.
		0.5C	1C	2C	3C	4C	5C		
MWCNT@S/NPC@PEG	54	1000	790	680	580	500	450	100^{th}, 527@1C	Our work
MWCNT@PPy/S	52.6	492	\	\	\	\	\	40^{th}, 961@0.2C	[1]
MWCNT@S@PPy	60.3	~300	~120	\	\	\	\	40^{th}, 600@0.03C	[2]
MWCNT@S@PPy	68.3	1060 (0.3C)	860 (0.9C)	665 (1.2C)	\	\	\	200^{th}, 560@0.9C	[3]
MWCNT@PPy/S	70	\	\	\	\	\	\	100^{th}, 726@0.1m Acm^{-2}	[4]
Nanowire-PPy/S	66.7	\	\	\	\	\	\	20^{th}, 570@0.1m Acm^{-2}	[5]
Nanowire-PPy/S	65	\	\	\	\	\	\	40^{th}, 500@0.06C	[6]
S@PPy core-shell	63.3	\	450	\	\	\	\	50^{th}, 634@0.2C	[7]
S/NPC	24	\	\	\	\	\	\	20^{th}, 573@0.05C	[8]
MWCNT@MesoC/S	60	~900 (0.6)	720 (1.6C)	\	\	\	\	50^{th}, 640@0.06C	[9]
MWCNT@S	57	800 (0.6C)	600	\	\	\	\	100^{th}, 1000@0.2C	[10]

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