Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A.

Supplementary information

Mesoporous TiN microspheres as efficient polysulfides barrier for lithium-sulfur batteries

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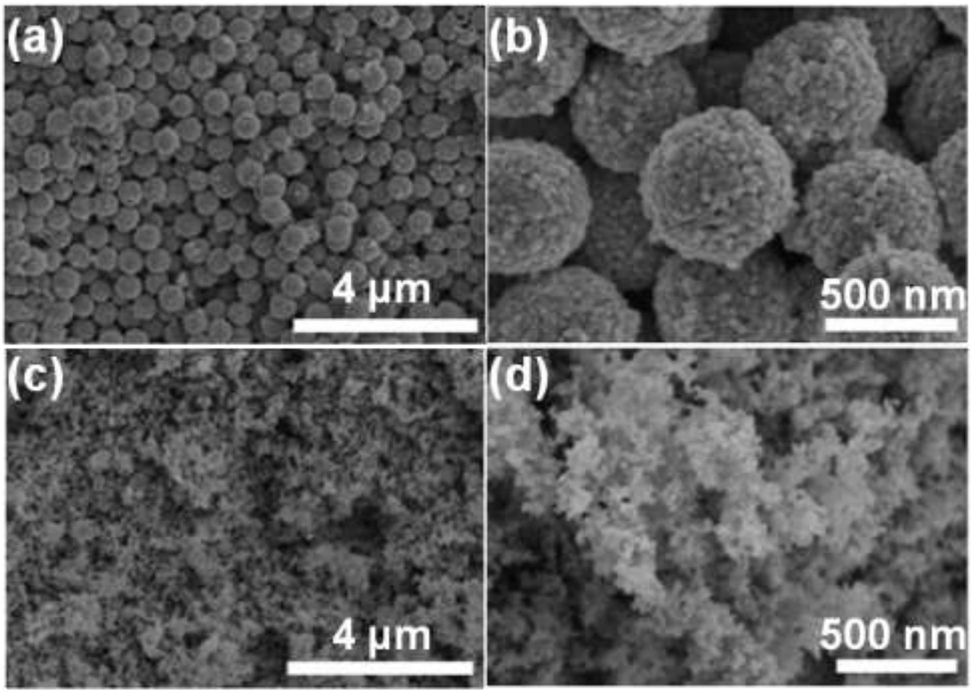

Figure S1 SEM images of the MTN microspheres (a, b) and the CTN nanoparticles (c, d).

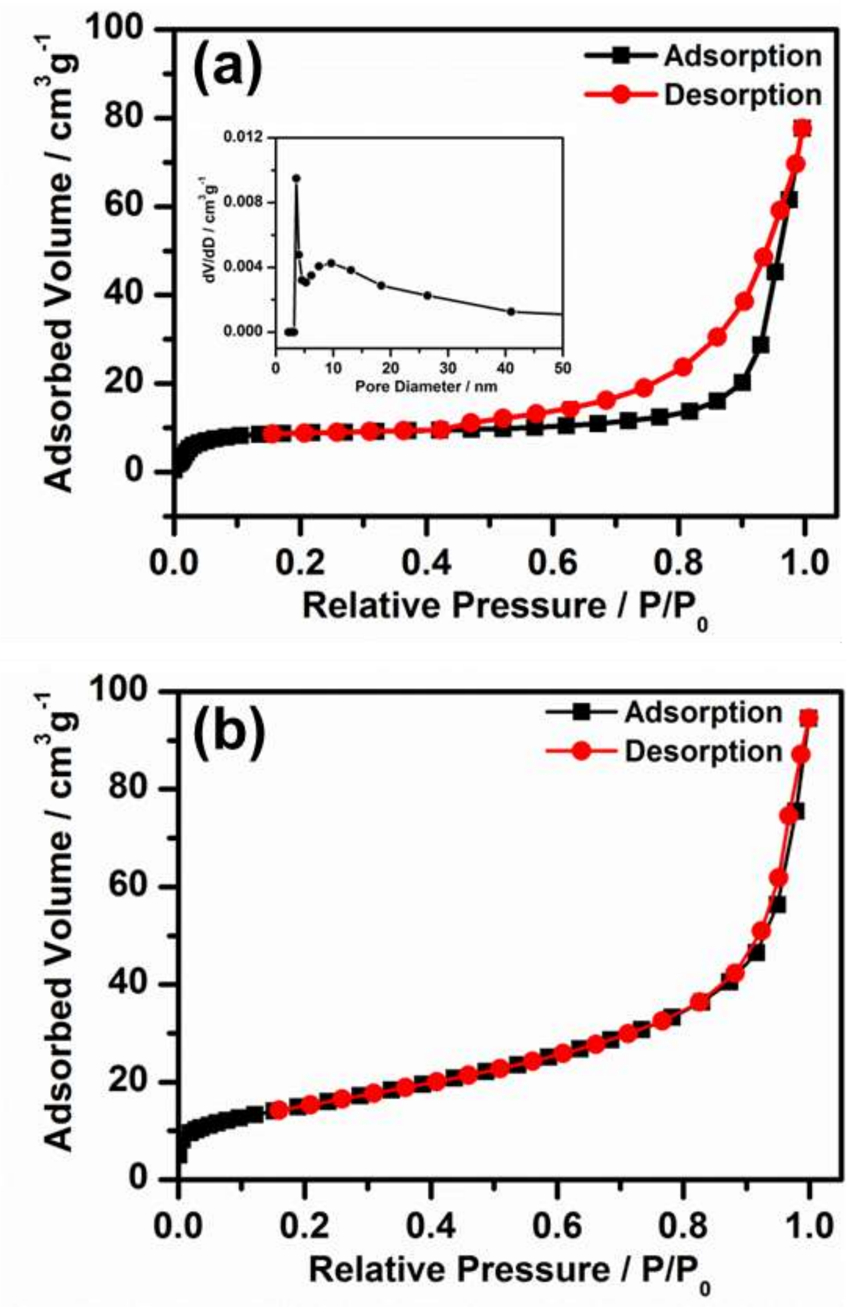

Figure S2 Nitrogen adsorption/desorption isotherms of the MTN microspheres (a) and the CTN nanoparticles (b). Inset of Figure S2a is the pore size distribution obtained using the BJH method.

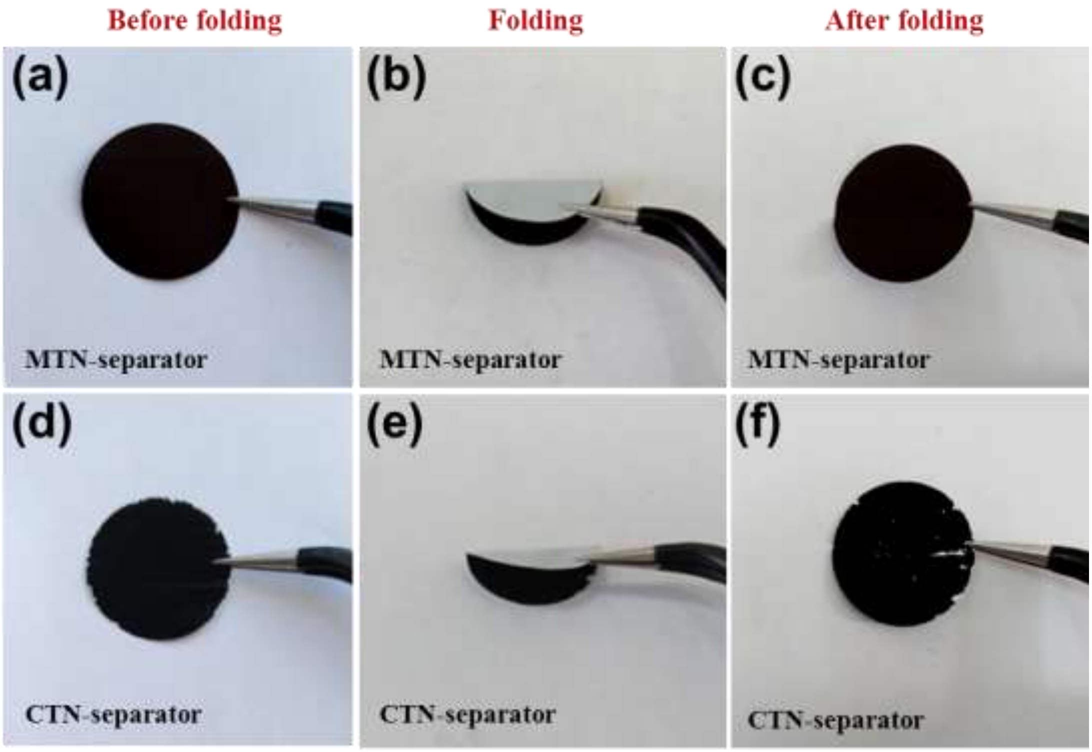

Figure S3 The photographs of the MTN-separator and the CTN-separator before folding (a, d), folding (b, e) and after folding (c, f), respectively.

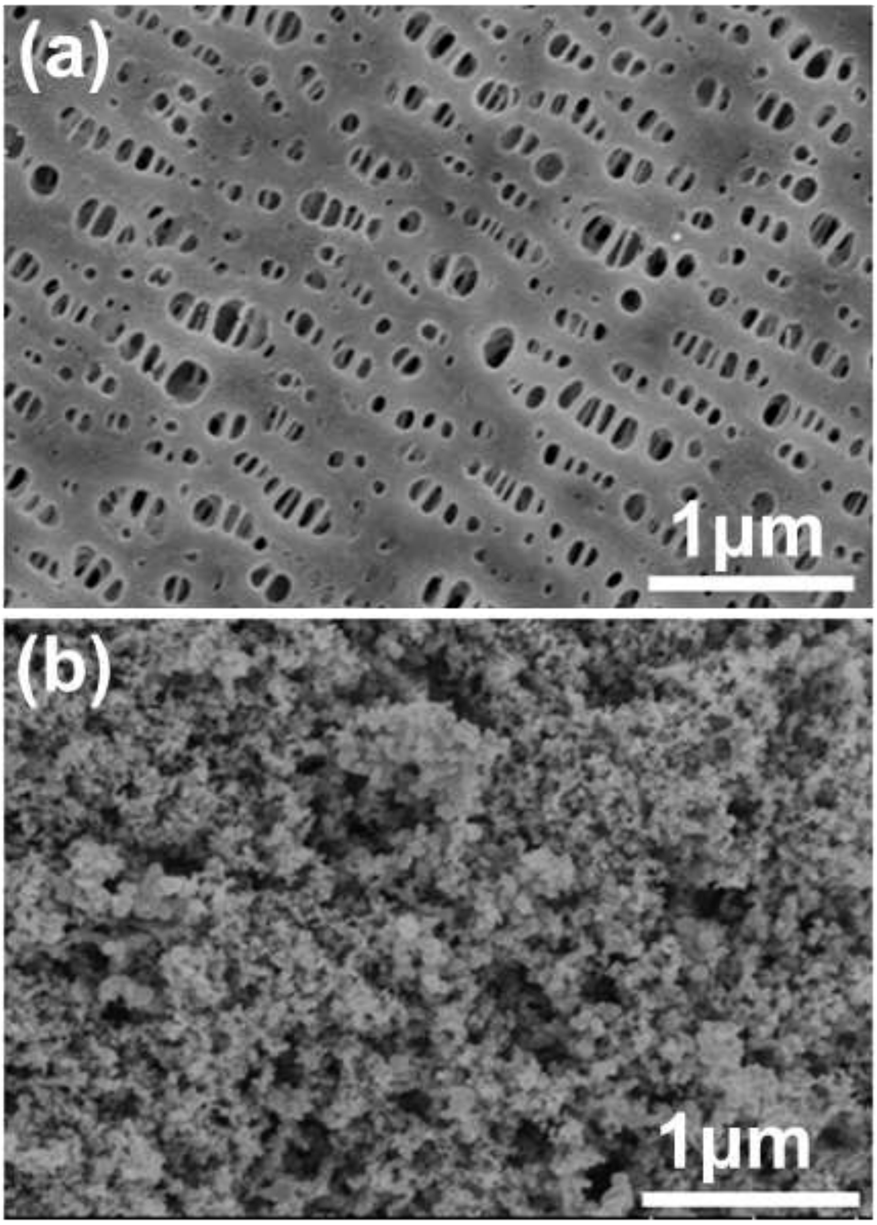

Figure S4 SEM images of the PP-separator (a) and the CTN-separator (b).

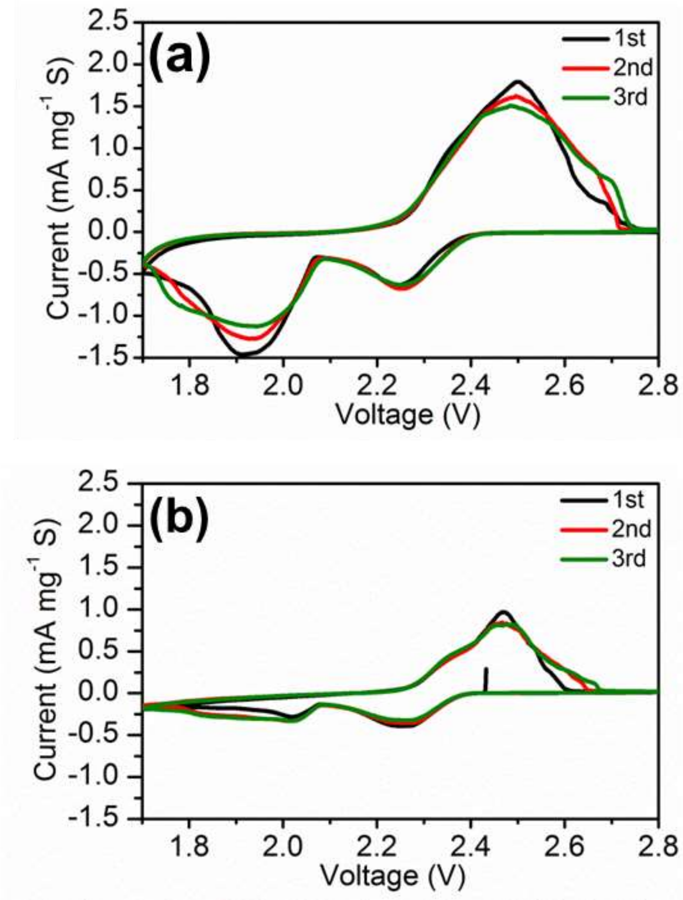

Figure S5 CV curves of the cells with the CTN-separator (a) and the PP-separator (b) at a scan rate of 0.1 mV S^{-1} in a potential window from 1.7 to 2.8 V.

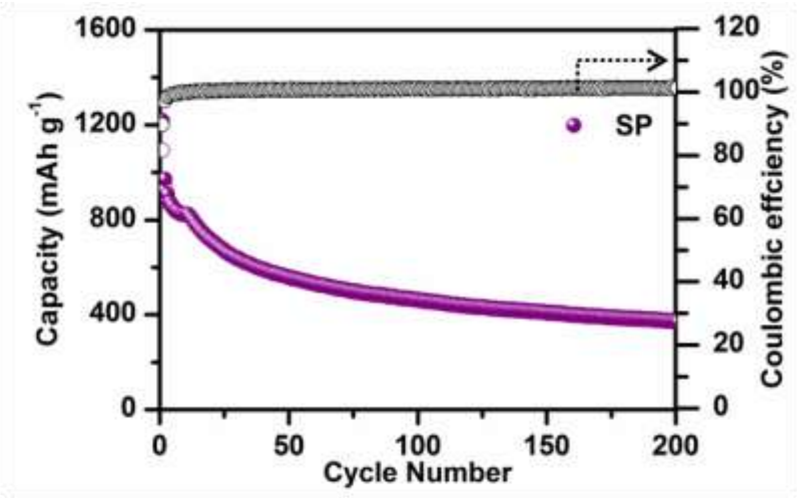

Figure. S6 Cycling performance and Coulombic efficiency of the cell with SP-separator at 0.5 C for 200 cycles.

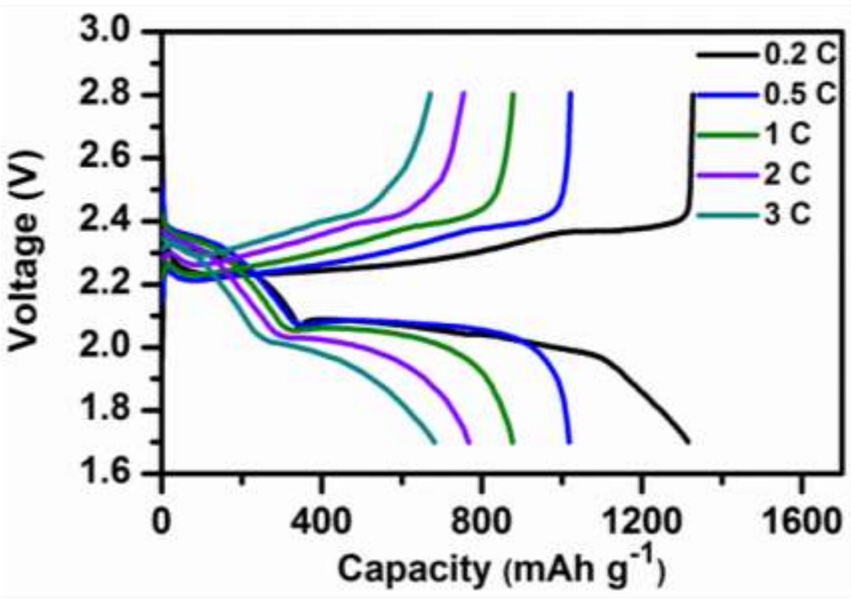

Figure S7 Galvanostatic charge/discharge profiles of the cell with the MTN-separator at various current densities from 0.2 C to 3 C.

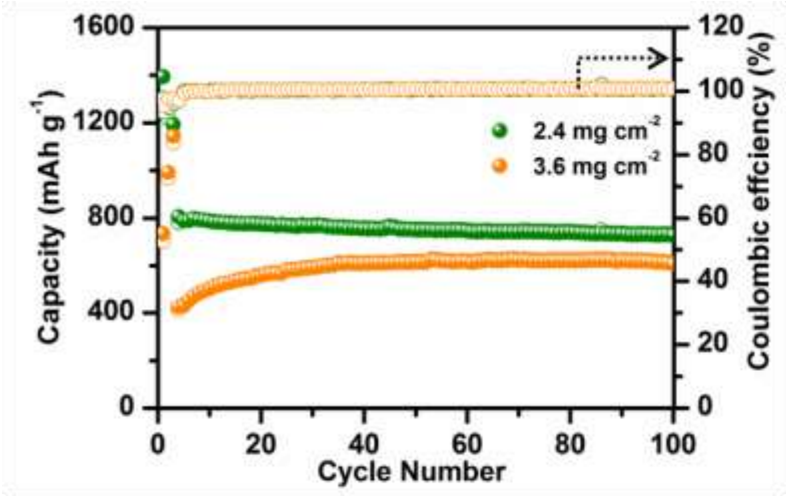

Figure. S8 Cycling performances for the cells with the MTN-separator at 1.0 C for 100 cycles with different sulfur loadings of 2.4 and 3.6 mg cm^{-2}.

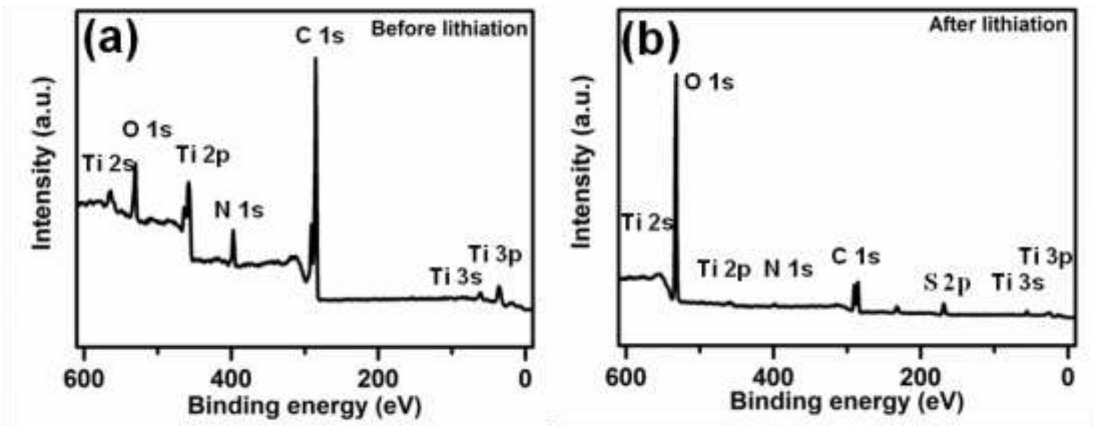

Figure S9 XPS survey spectra of the MTN-separator before cycling (a) and after lithiation at the 1.7 V discharge state (150th cycle) (b).

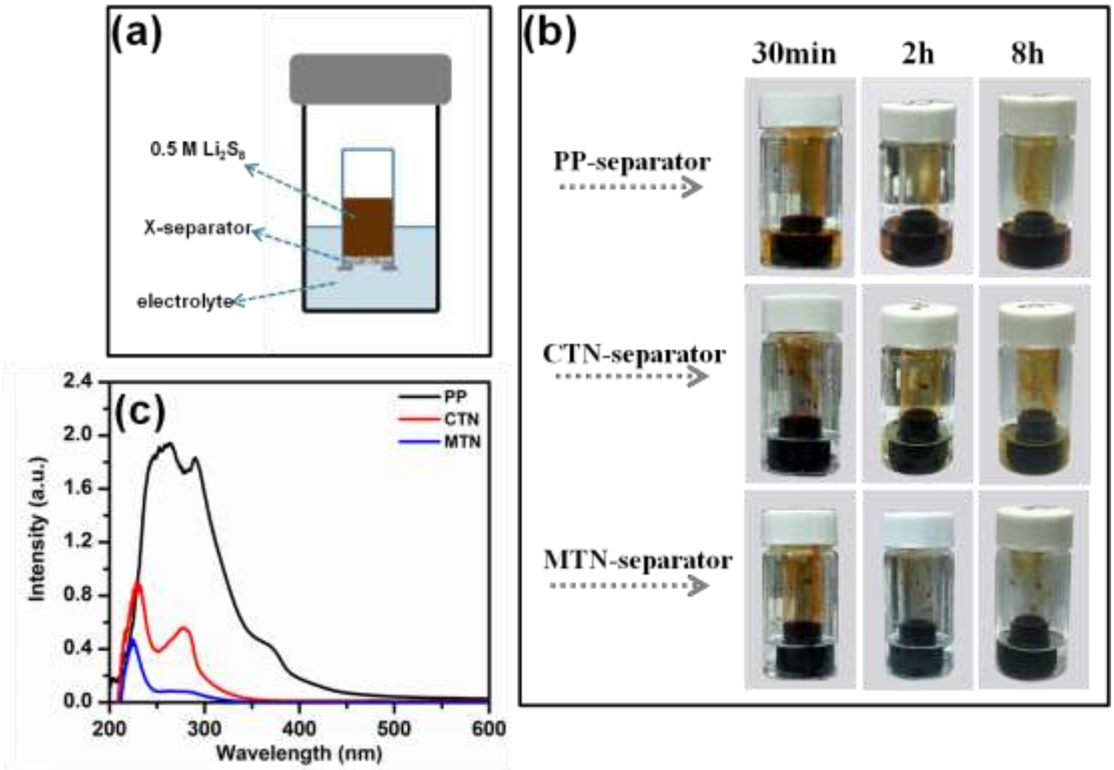

Figure S10 (a) Schematic illustration of the LiPSs permeating test. (b) Photographs of the results of LiPSs permeability tests for 30 min, 2 h and 8 h with the PP-separator, the CTN-separator and the MTN-separator, respectively. (c) Ultraviolet/visible absorption spectra of a Li_2S_8 solution permeating into the fresh electrolyte through each separator after 2 hours.

Table S1 Tap density of the materials.

Samples	MTN	CTN	Super P
Tap density (g/cm^{-3})	1.2	0.1	0.09

Table S2 Performances comparison of this work with previous works using the similar separator-modification strategy for Li-S batteries.

Coating or interlayer	Area weight of sulfur ($mg\ cm^{-1}$)	Current rate	Discharge capacities ($mAh\ g^{-1}$) and (cycle number)	Rate capacity ($mAh\ g^{-1}$)	Ref.
rGO–PVDF/PVDF-2	0.8-1.1	0.2 C	646 (200)	590 (2 C)	S1
GO-TiC	1.1-1.4	0.3 C	765 (200)	643 (2 C)	S2
TiN particles	1.7	0.5 C	605 (250)	329 (2 C)	S3
porous carbon modified GF	0.8-1.1	0.2 C	991 (50)	493 (1 C)	S4
N and P doped graphene	2.1	1.0 C	638 (500)	634 (2 C)	S5
Nano-TiO_2	2.0	0.5 C	762 (200)	710 (2 C)	S6
TiN microspheres	1.3	0.5 C	744 (200)	767 (2 C) 672 (3 C)	This work

Table S3 Electrical conductivity of the separators.

Samples	MTN-separator	CTN-separator	PP-separator
Electrical conductivity (S/m)	27.8	1.3	------

Table S4 Impedance parameters calculated according to the equivalent circuits.

Samples	$R_S(\Omega)$	$R_{ct}(\Omega)$
MTN-fresh	------	17.19
MTN-100th	8.066	0.928
CTN-fresh	------	50.63
CTN-100th	15.15	24.53
PP-fresh	------	59.70
PP-100th	25.57	45.53

References:

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