Supporting Information

LDH-derived $Co_{0.5}Ni_{0.5}Te_2$ Dispersed in 3D Carbon Sheets as Separator Modifier to Enable Kinetics-Accelerated Lithium-Sulfur Batteries

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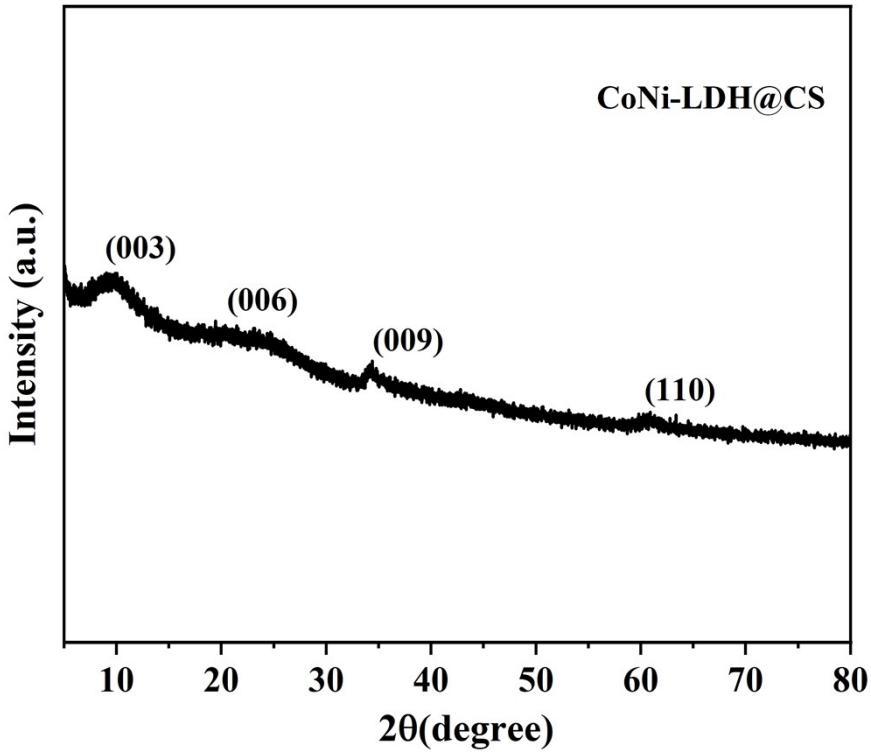

Fig. S1 The XRD pattern of CoNi-LDH@CS.

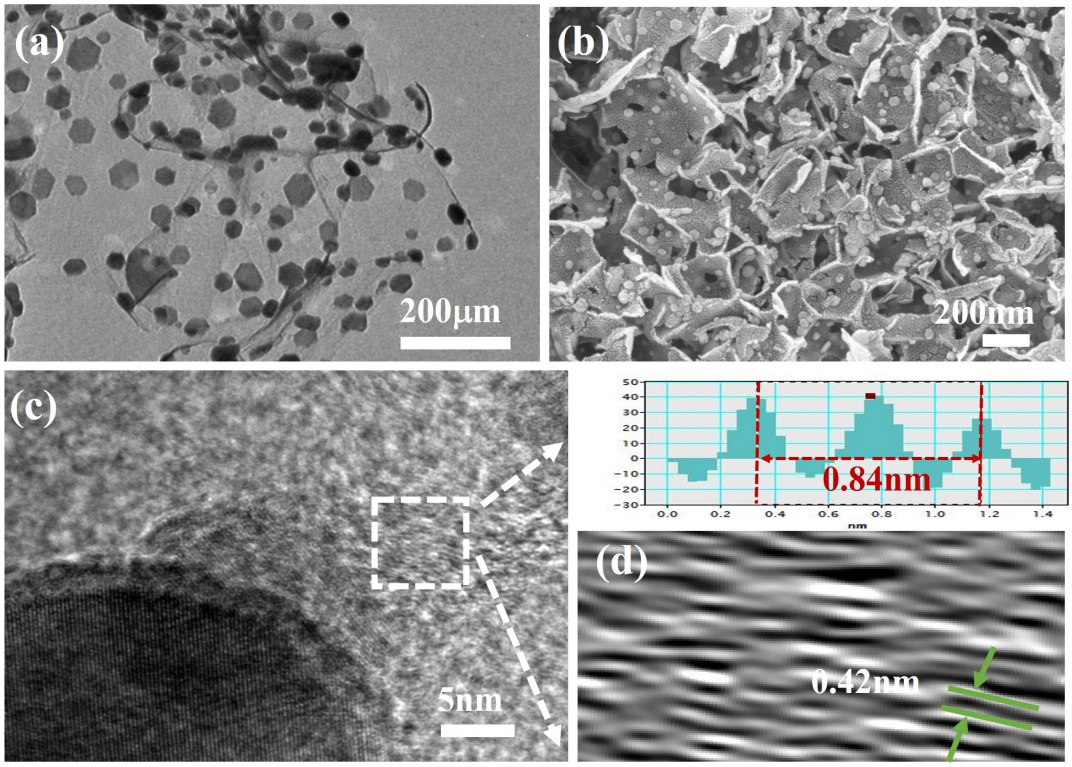

Fig. S2 (a-b) TEM and SEM images of $Co_{0.5}Ni_{0.5}Te_2$@CS. (c-d) HRTEM image of $Co_{0.5}Ni_{0.5}Te_2$@CS and lattice fringes of CS.

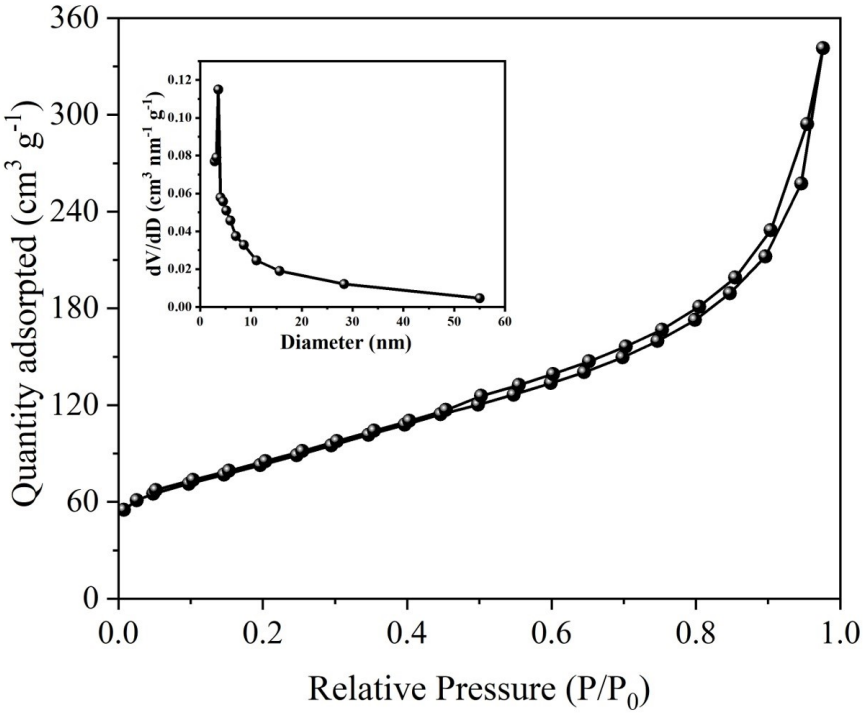

Fig. S3 N_2 adsorption-desorption isotherm and pore size distribution (inset) of CS.

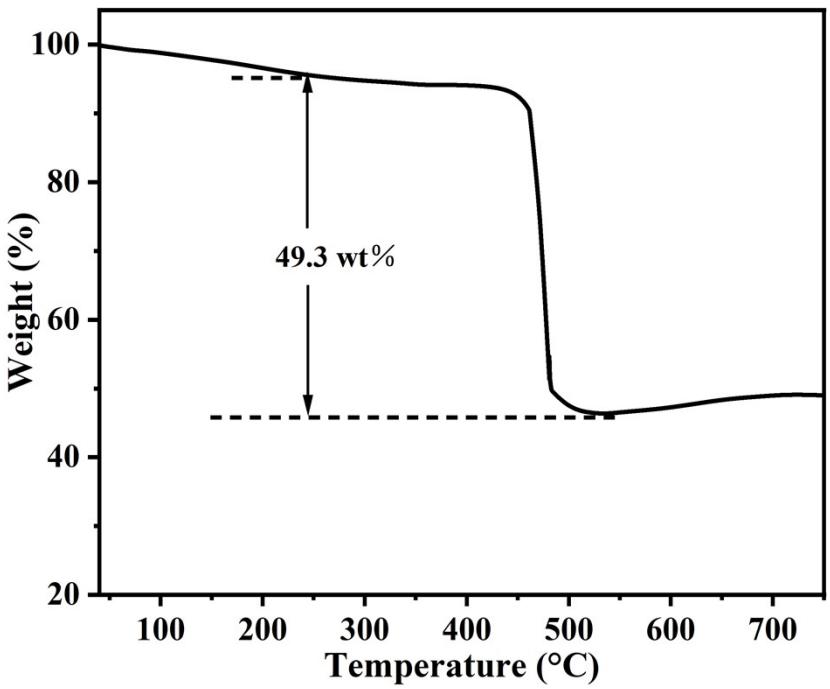

Fig. S4 TGA curve of $Co_{0.5}Ni_{0.5}Te_2$@CS.

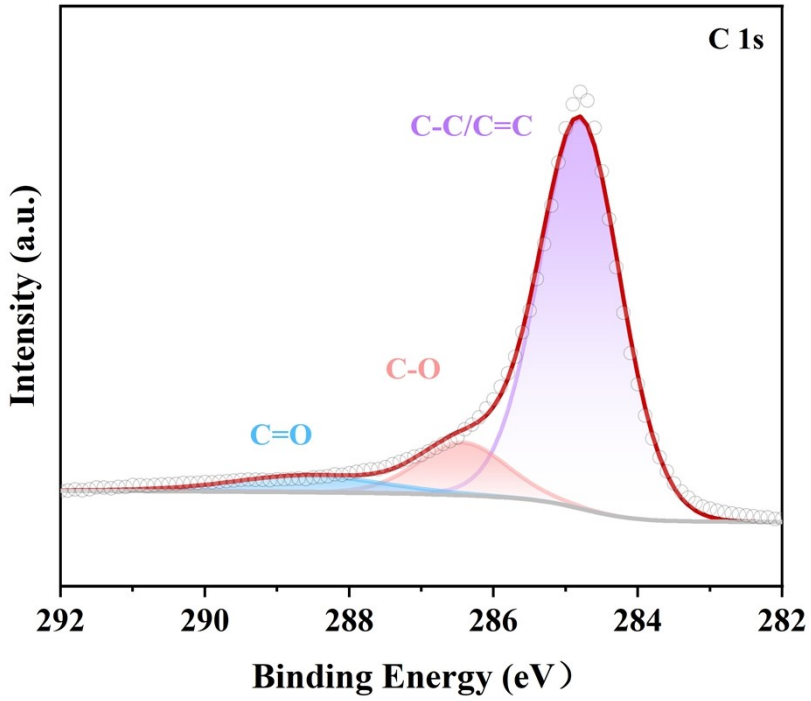

Fig. S5 XPS spectra of C1s.

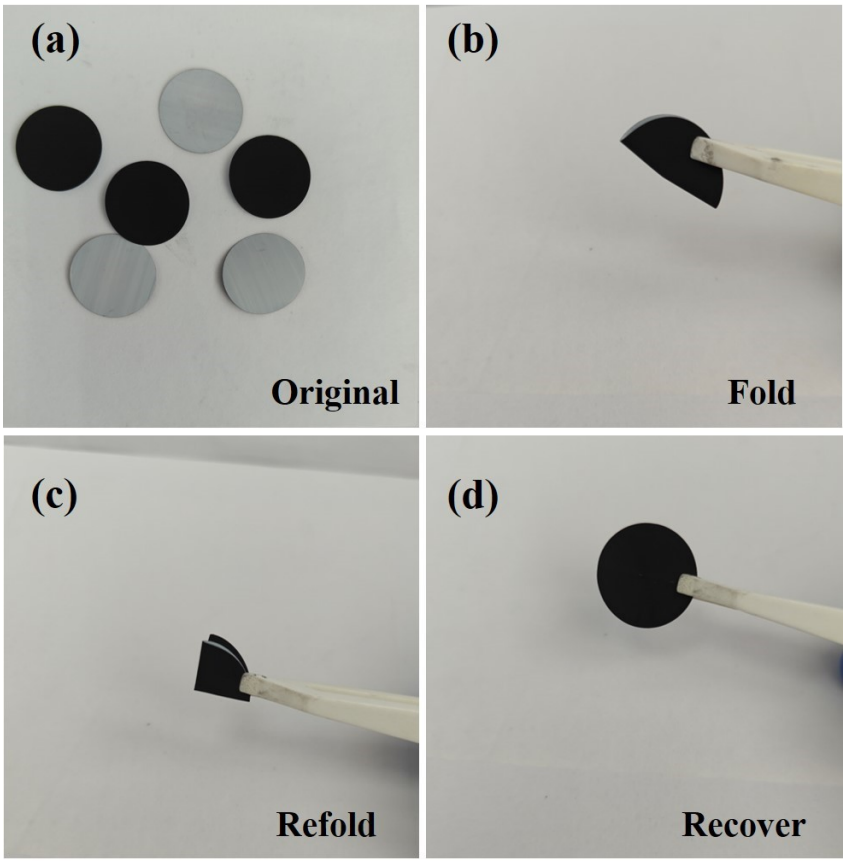

Fig. S6 The visual pictures of modified separator with $Co_{0.5}Ni_{0.5}Te_2$@CS as coating layer (a) the original state, (b-c) folding and refolding state, (d) recovering state.

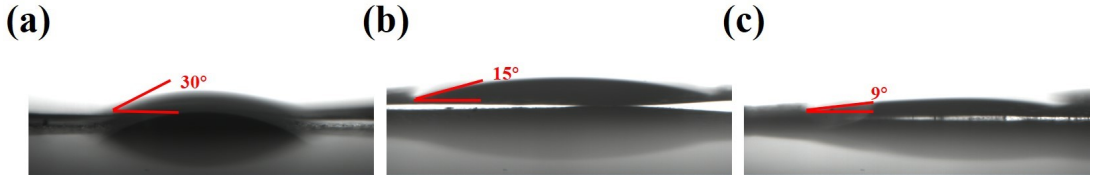

Fig. S7 The contact angles between electrolyte and (a) PP, (b) CS/PP and (c) $Co_{0.5}Ni_{0.5}Te_2$@CS/PP.

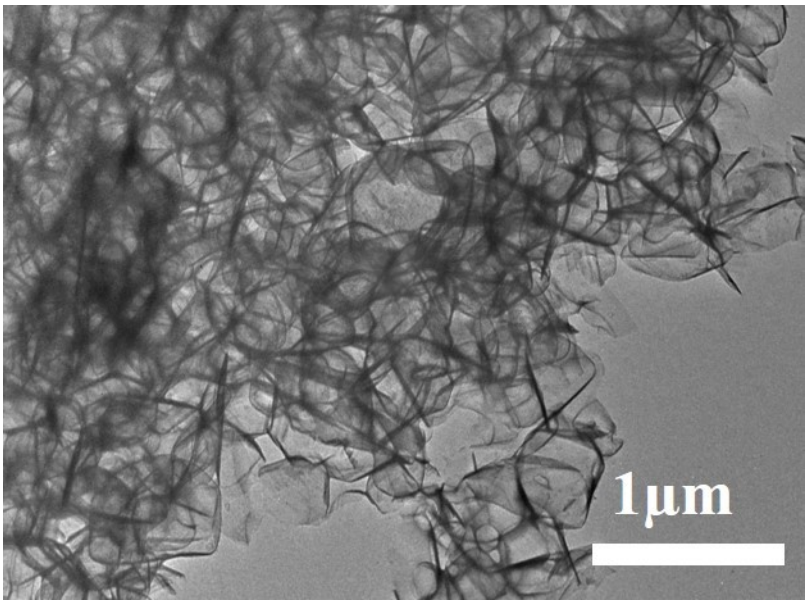

Fig. S8 TEM images of NPCS

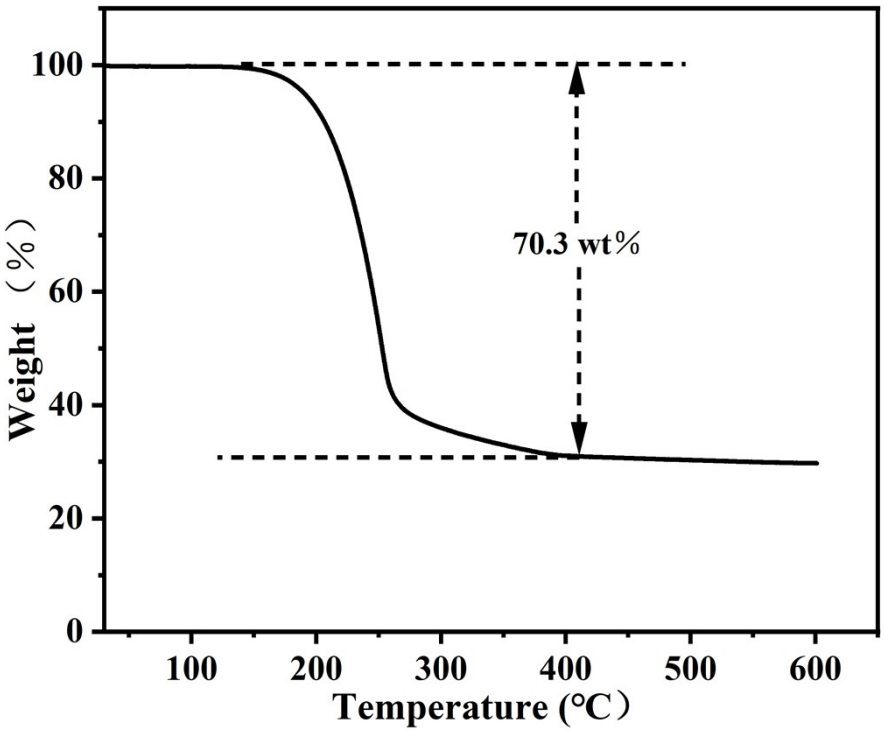

Fig. S9 TGA curve of S/NPCS.

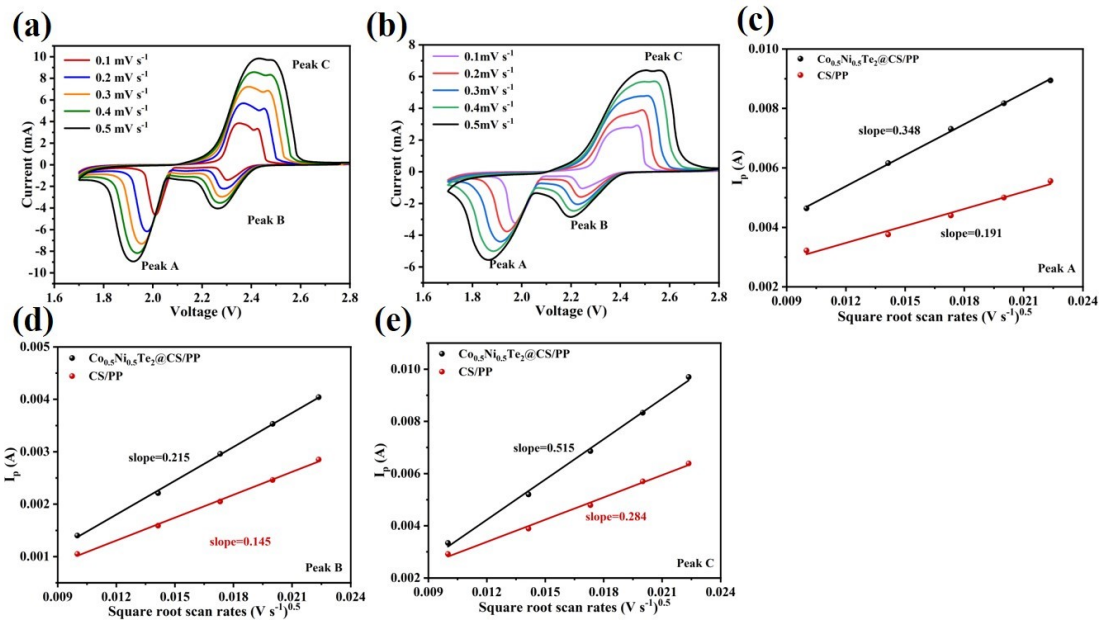

Fig. S10 CV profiles of cell with $Co_{0.5}Ni_{0.5}Te_2$@CS/PP (a) and CS/PP (b) at various scan rates of 0.1-0.5 mV s^{-1} and (c-e) the linear fitting curves of I_p-$\nu^{0.5}$ at peak A, B and C for cells with $Co_{0.5}Ni_{0.5}Te_2$@CS/PP and CS/PP.

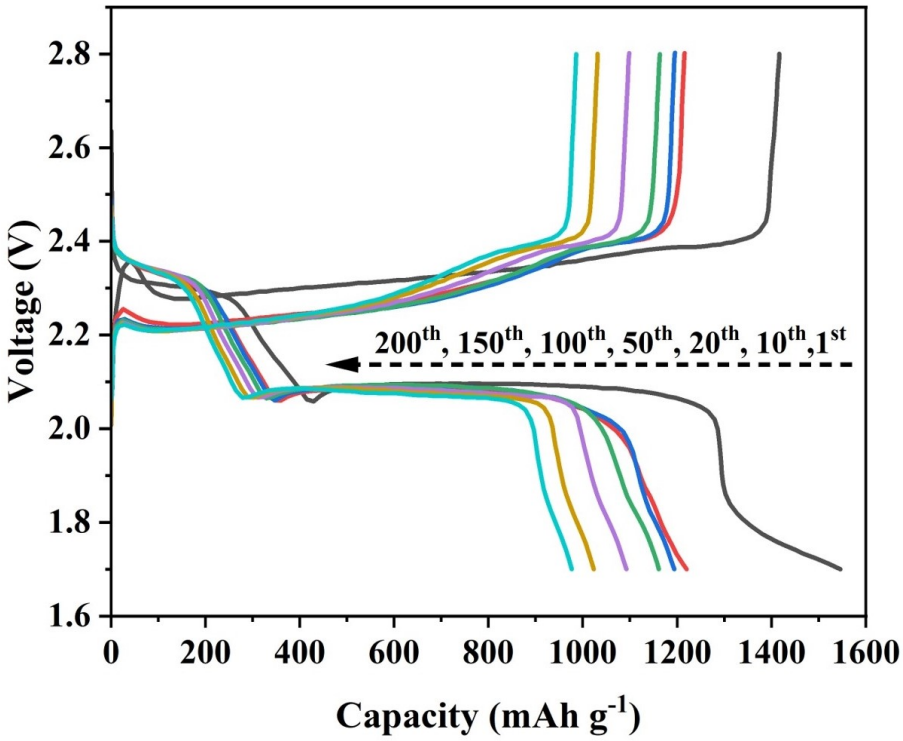

Fig. S11 The galvanostatic charge/discharge profiles of S//$Co_{0.5}Ni_{0.5}Te_2$@CS/PP with different cycles at 0.5 C.

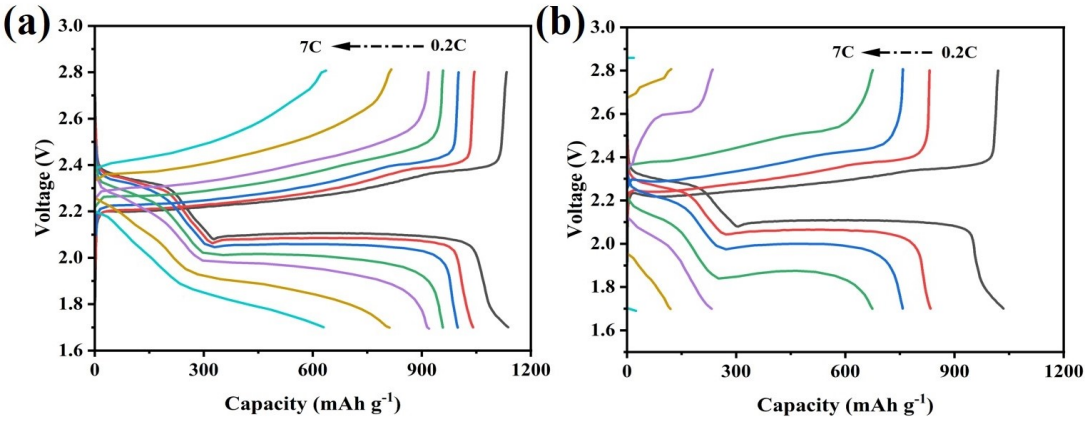

Fig. S12 The discharge-charge profiles at various rates ranged from 0.2 to 7 C: (a) S//CS/PP and (b) S//PP.

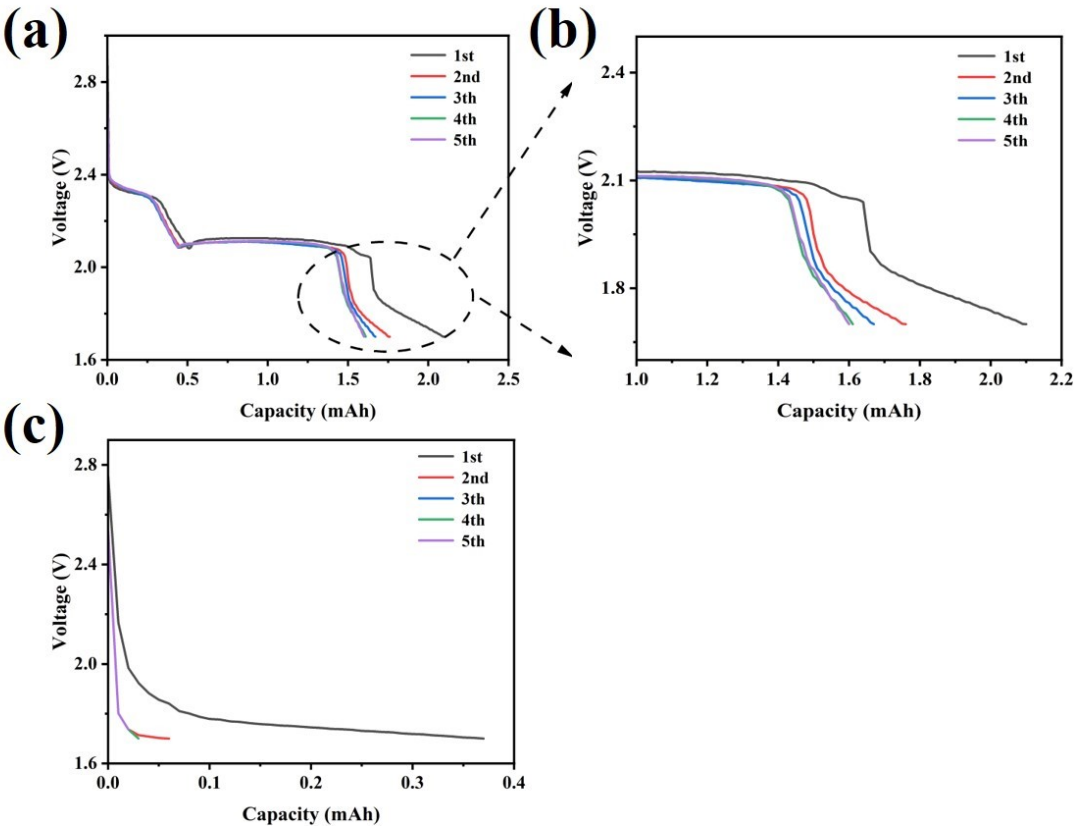

Fig. S13 (a-b) The voltage profiles of the cell with S//$Co_{0.5}Ni_{0.5}Te_2$@CS/PP at 0.2 C. (c) the voltage profiles of blank aluminum foil as electrode with $Co_{0.5}Ni_{0.5}Te_2$@CS/PP at 350 mA.

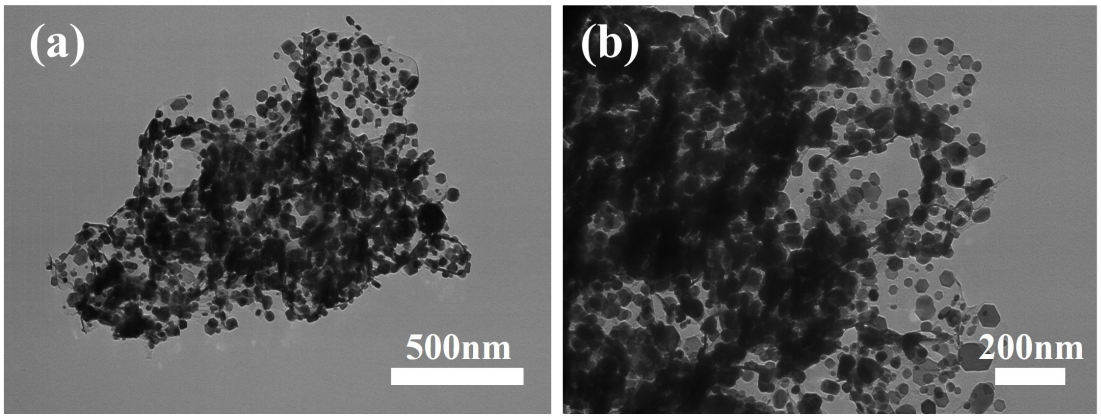

Fig. S14 TEM images of M-$Co_{0.5}Ni_{0.5}Te_2$@CS.

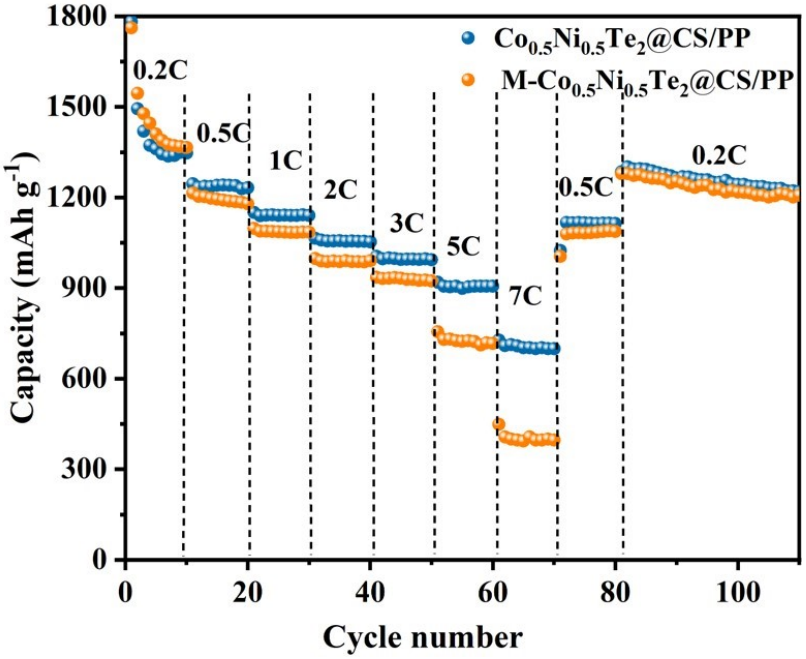

Fig. S15 the comparison of rate performance of cells with $Co_{0.5}Ni_{0.5}Te_2$@CS/PP and M-$Co_{0.5}Ni_{0.5}Te_2$@CS/PP

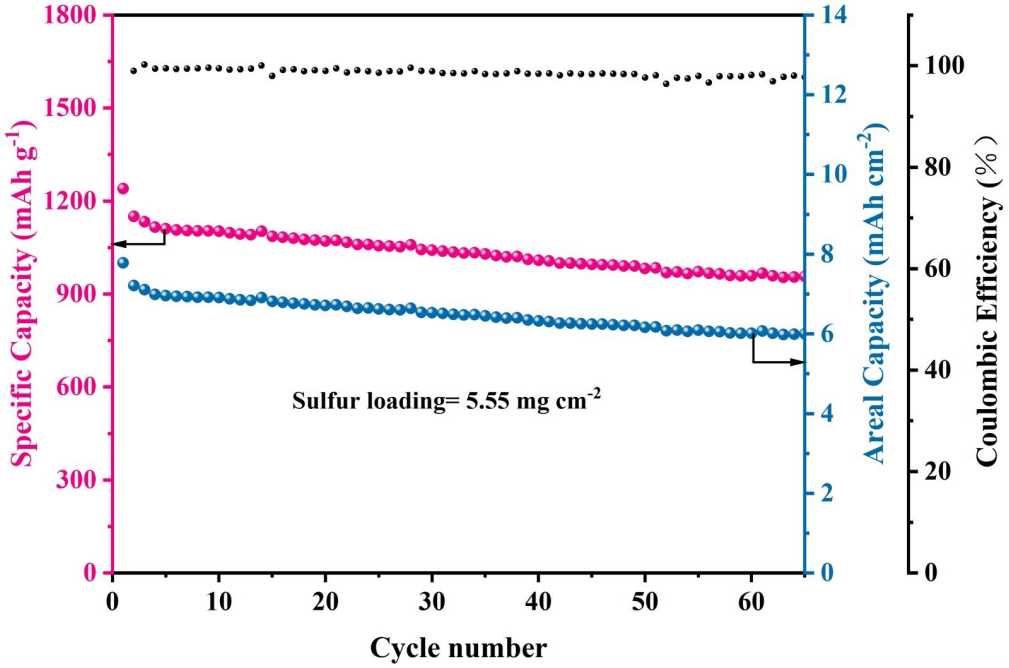

Fig. S16 The cycling stability of S//$Co_{0.5}Ni_{0.5}Te_2$@CS/PP with sulfur loading of 5.55mg cm^{-2}.

Table S1. The values of Q1, Q2 and the ratios of Q2/Q1

	Q1 (mAh g^{-1})	Q2 (mAh g^{-1})	Q2/Q1
PP	306	663	2.16
CS/PP	323	737	2.28
$Co_{0.5}Ni_{0.5}Te_2$@CS/PP	360	934	2.59

Table S2. Comparison of Li-S battery performance assembled with different modified separators.

Separator Modifier	Loading (mg cm^{-2})	C Rate	Cycle number	Capacity Rentention (mAh g^{-1})	Ref
SV-VS_2	0.50	0.2	150	921	[1]
NSPCF@CoS_2	0.98	0.5	100	665	[2]
Oxygen-doped carbon/rGO	0.50	0.1	200	830	[3]
Ta_4C_3-Ta_2O_5	0.81	1	500	457.1	[4]
TiB_2@Graphene	0.88	0.5	300	850	[5]
Fe_3O_4/RGO	0.60	0.3	200	563	[6]
Local 3D Co_3O_4	0.43	2	300	548	[7]
$NiCo_2O_4$/CNF	2.00	2	500	658	[8]
Ni/PCMS	0.32	0.5	200	623.5	[9]
Ni/NiO-C	0.54	1	500	484	[10]
CoN@NCNT	0.54	0.2	200	729.7	[11]
PC/MWCNT	0.51	0.5	200	659	[12]
α-MnO_2 @CNT	0.60	0.2	100	941	[13]
TiO_2@SCNT	0.34	0.5	200	848	[14]
Co@N-CNTs	0.64	1	500	610	[15]
NbN@NC	0.30	2	400	780.6	[16]
$Co_{0.5}Ni_{0.5}Te_2$@CS/PP	**0.43**	**0.5**	**200**	**976.3**	**This work**
		2	**500**	**784.8**	

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