Electronic Supplementary Material (ESI) for Nanoscale.

Supporting information

Multiwalled Carbon Nanotube@*a*-C@Co_9S_8 Nanocomposites: a High-Capacity and Long-Life Anode Material for Advanced Lithium Ion Batteries

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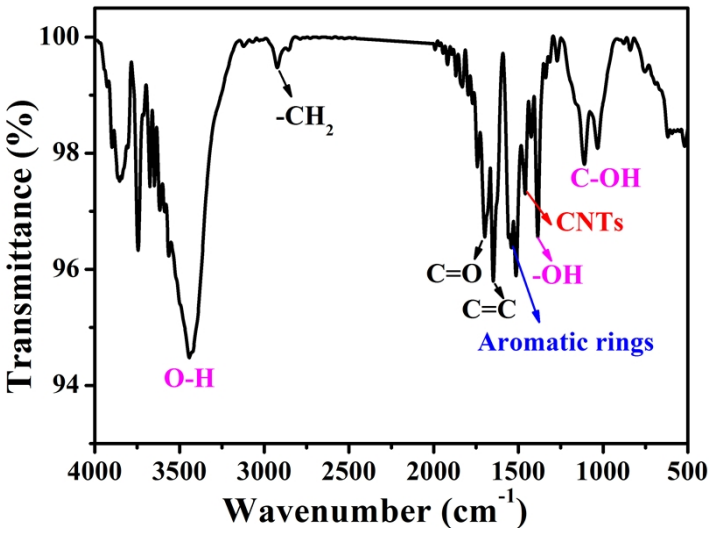


Fig. S1 Infrared spectrum (IR) of the product obtained by treating MWCNTs with glucose via a hydrothermal process.

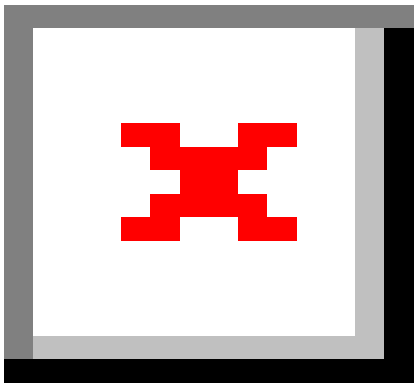


Fig. S2 (a-d) TEM images of the product obtained by treating MWCNTs with different amounts of glucose via a hydrothermal process. (a) 0.01 g/mL, (b) 0.014g/mL, (c) 0.02 g/mL, and (d) 0.04g/mL.

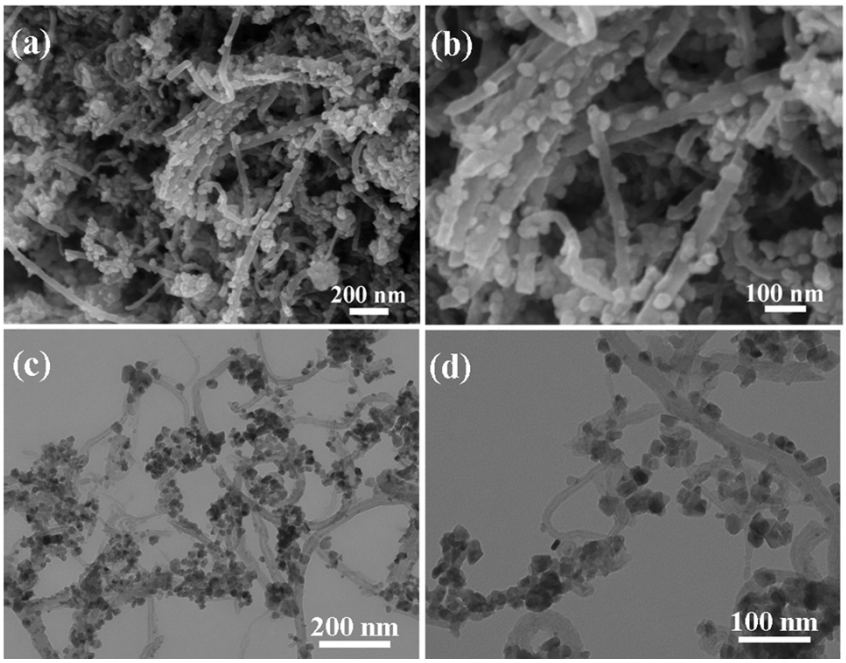
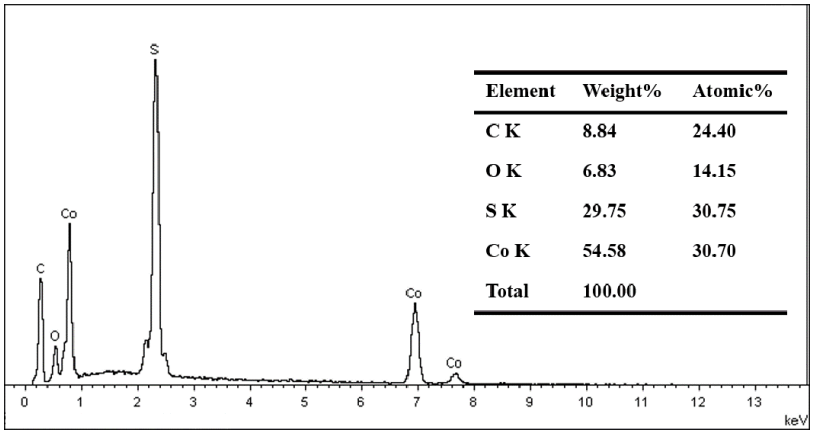


Fig. S3 (a,b) SEM images, and (c,d) TEM images of the product obtained after the solvothermal reaction between thiourea and $Co(Ac)_2$.



Element	Weight%	Atomic%
C K	8.84	24.40
O K	6.83	14.15
S K	29.75	30.75
Co K	54.58	30.70
Total	100.00	

Fig. S4 EDS spectrum of the MWCNT@*a*-C@Co_9S_8 nanocomposite.

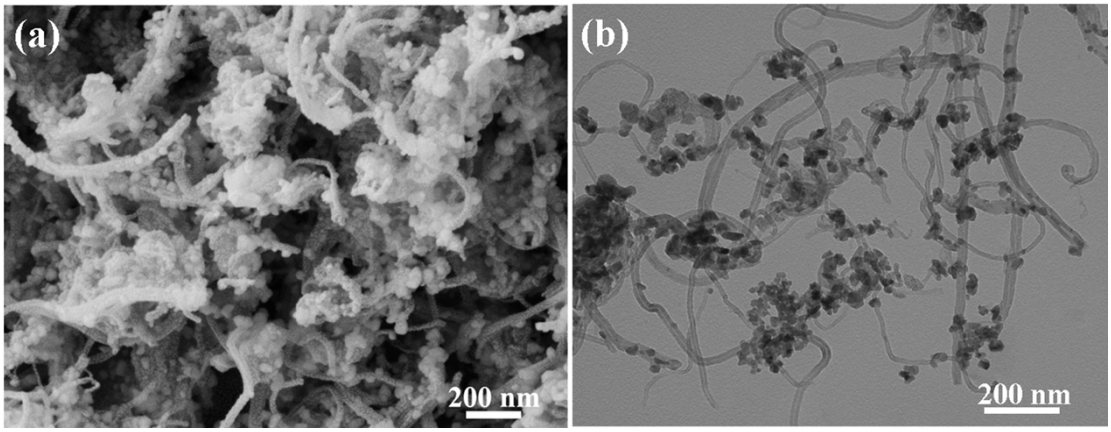


Fig. S5 (a) SEM and (b) TEM images of the MWCNT@Co_9S_8 nanocomposite obtained without the hydrothermal treatment by glucose.

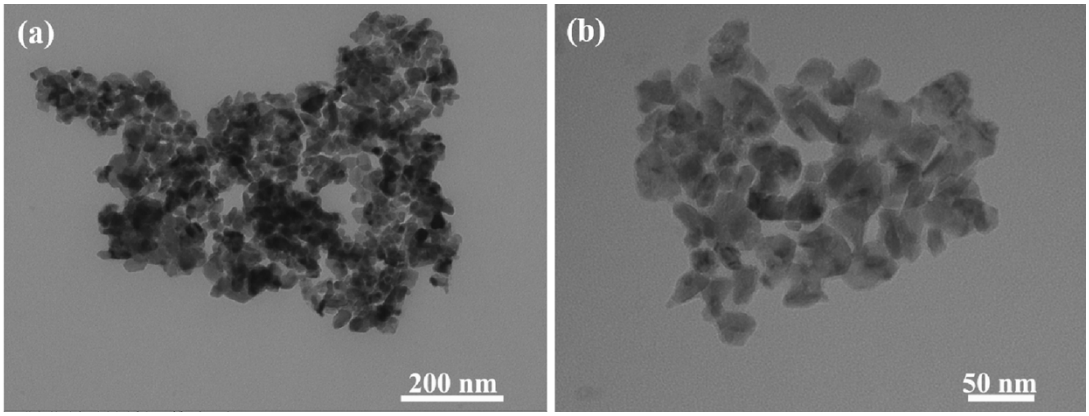


Fig. S6 (a) SEM image and (b) TEM image of Co_9S_8 nanoparticles.

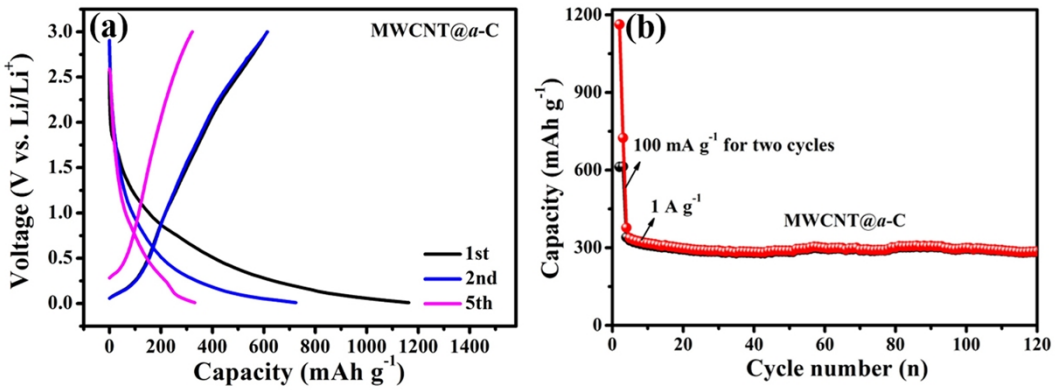


Fig. S7 (a) Galvanostatic discharge/charge profiles and (b) cycling performance of MWCNT@*a*-C at 1 A g^{-1}(the electrode was first cycled at 100 mA g^{-1} for two cycles).

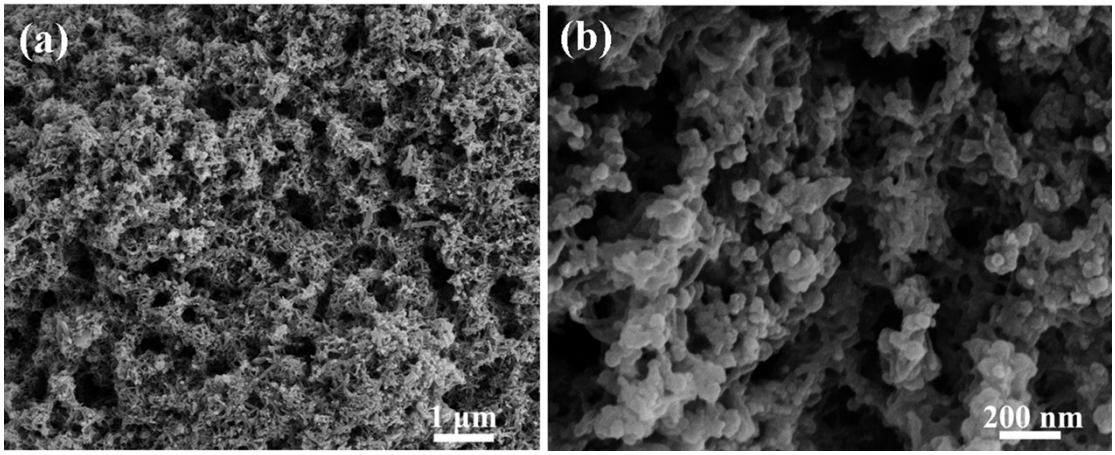


Fig. S8 (a) and (b) SEM images of MWCNT@*a*-C@Co_9S_8 nanocomposites electrode after 50 cycles.

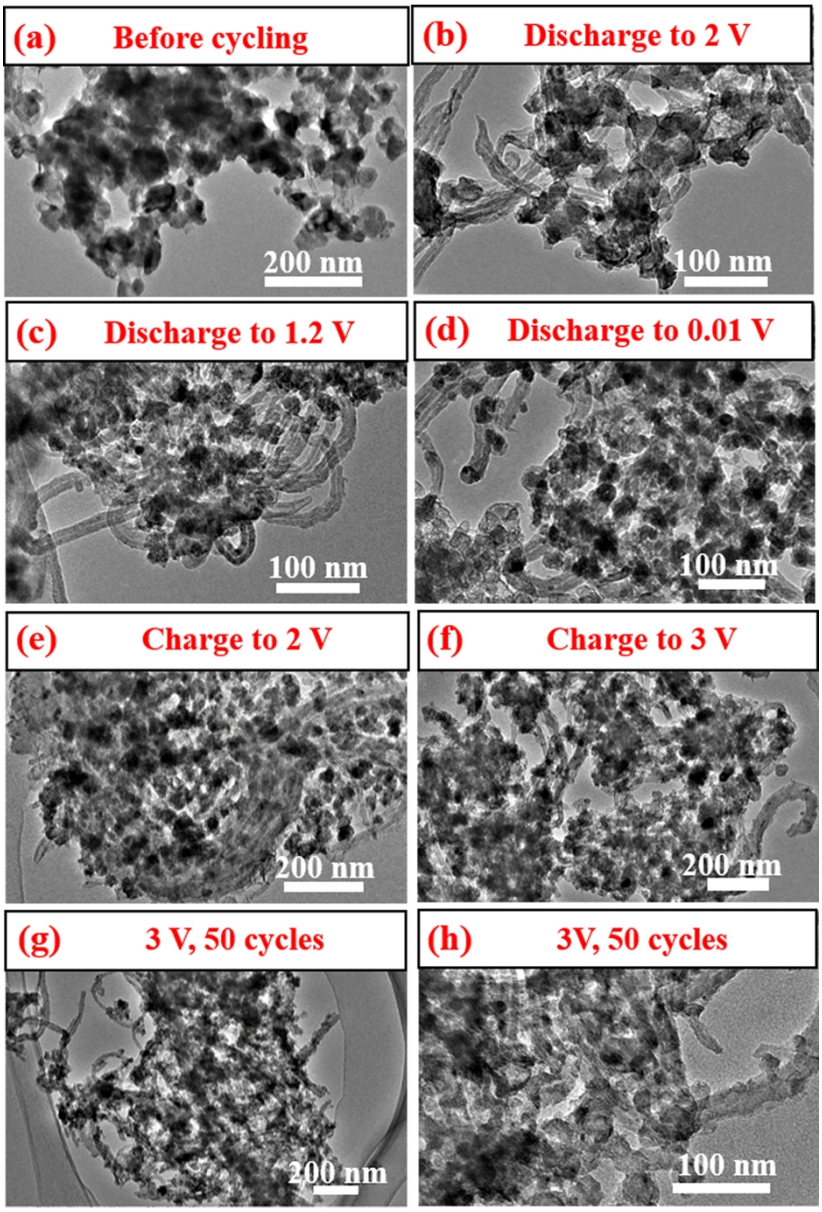


Fig. S9 TEM images of the anode material at different depth of discharge (b-d) and state of charge (e,f). (a) before the cycling, (b-d) first discharge to 2.0, 1.2 or 0.01 V, (e, f) first charge to 2 or 3 V, (g, h) 3 V after 50 cycles.

Table S1. The comparison of cycling performances of some reported cobalt sulfide nanocomposites.

Materials	Current Density ($mA\ g^{-1}$)	Cycle Number	Capacity ($mAh\ g^{-1}$)	Ref.
Spherical CoS_2@Carbon	0.2 $mA\ cm^{-2}$	50	440	19
Cobalt Sulfides/Graphene Nanocomposite	100	50	950	21
CoS_2/RGO Nanocomposites	100	50	640	22
Graphene Oxide/Cobalt Sulfide	200	150	994	23
Graphene-Wrapped CoS Nanoparticles	625	100	<500	20
C@Co_9S_8 Nanodandelions	1000	50	520	18
C@Co_9S_8 Nanoparticles	1000	50	338	18
CoS sheets/Graphene	1178 1767	200	~ 470 ~ 391	24
MWCNT@*a*-C@Co_9S_8 Nanocomposites	**1000** **2000**	**120** **700**	**662** **1065**	**Our work**