Electronic Supplementary Material (ESI) for New Journal of Chemistry.

Supplementary Materials

Ultrafine $Co_{0.85}Se$ nanocrystals dispersed in 3D CNT network as flexible free-standing anode for high performance Lithium-ion battery

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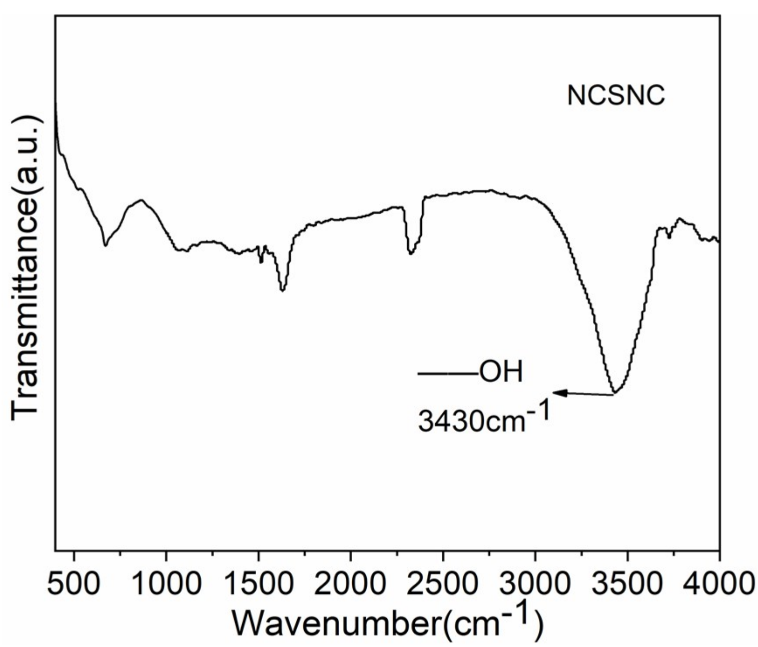

Figure. S1 FTIR spectra of NCSNC.

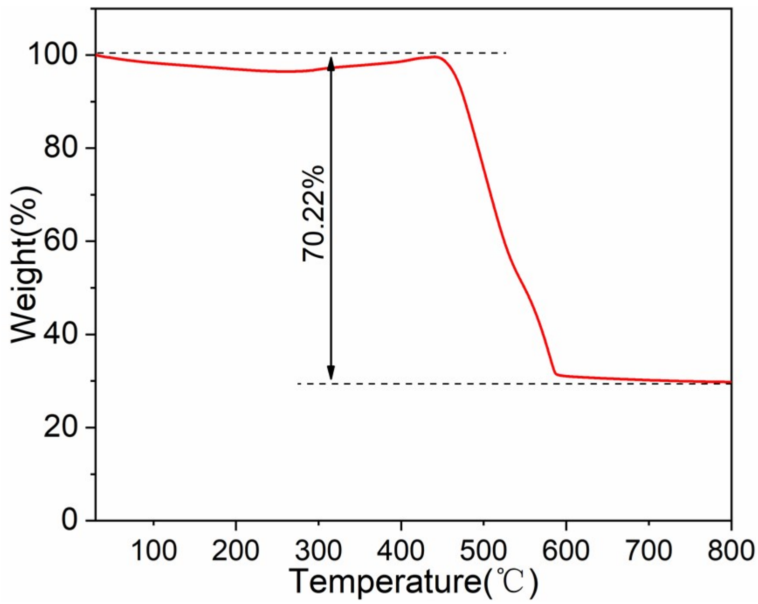

Figure. S2 TGA analysis of NCSNC@C/CNT, through which the mass ratio of NCSNC in NCSNC@C/CNT is calculated to be 56.33% in total.

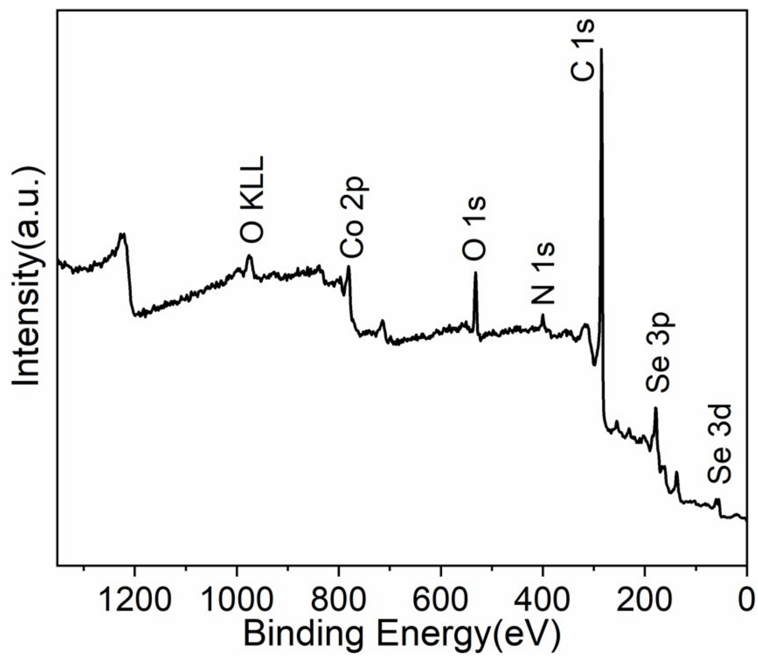

Figure. S3 XPS spectra of NCSNC@C/CNT.

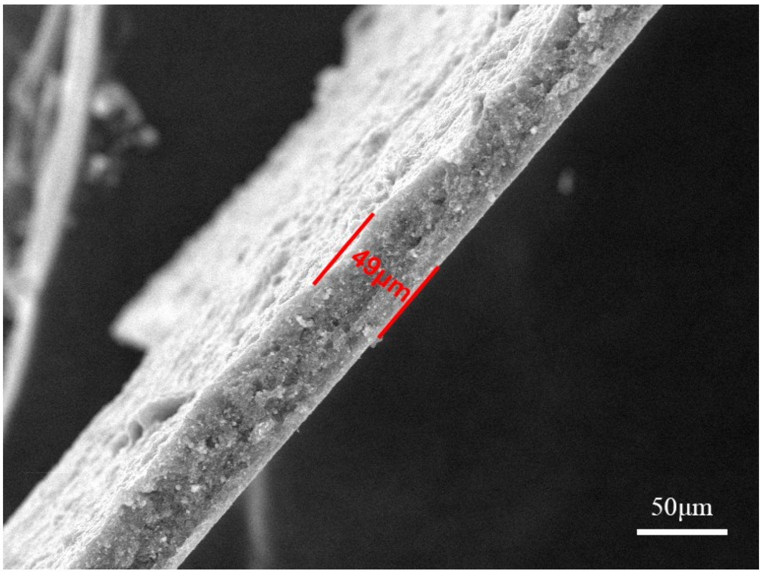

Figure. S4 Cross section SEM image of the as prepared NCSNC@C/CNT film, the thickness of the film is about 49μm.

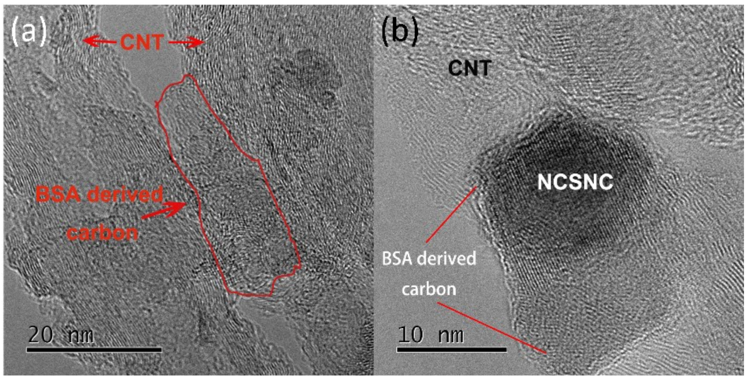

Figure. S5 TEM image of NCSNC@C/CNT: (a) BSA derived carbon helps to connect CNTs and improves the plasticity of the as-prepared composite film; (b) BSA derived carbon helps to anchor NCSNC onto CNT and ensure an efficient electron transport.

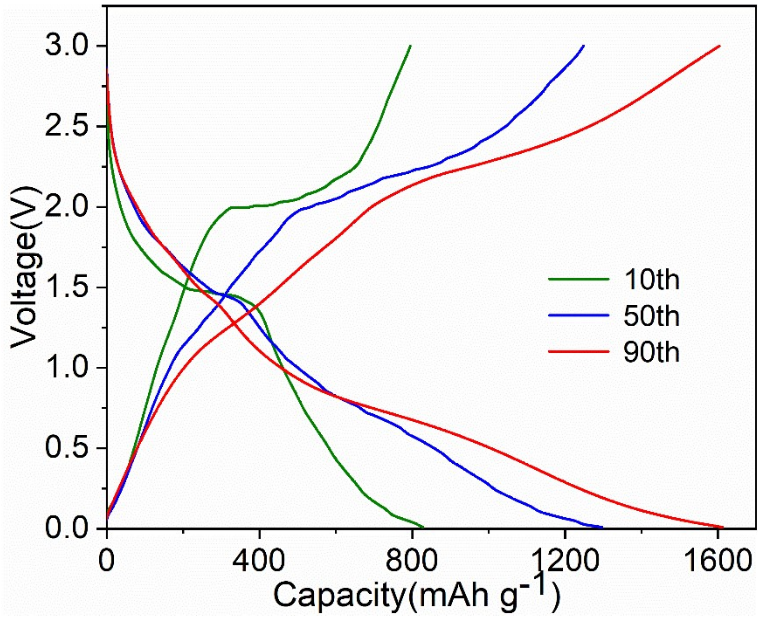

Figure. S6 The 10th, 50th and 90th Charge-discharge curves of NCSNC@C/CNT composite film electrode.

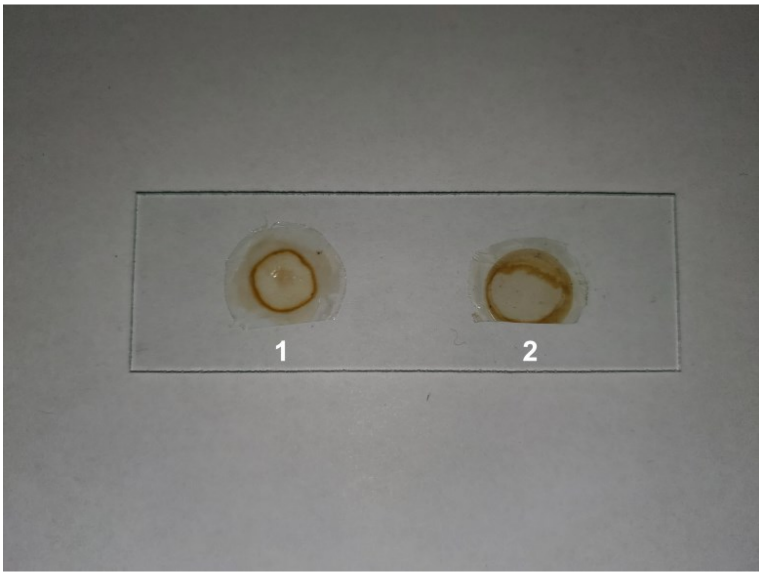

Figure. S7 Separators of the after-cycling half coin cells for 250 cycles a the current density of 1A/g(1) NCSNC@C/CNT. (2) NCSNC.

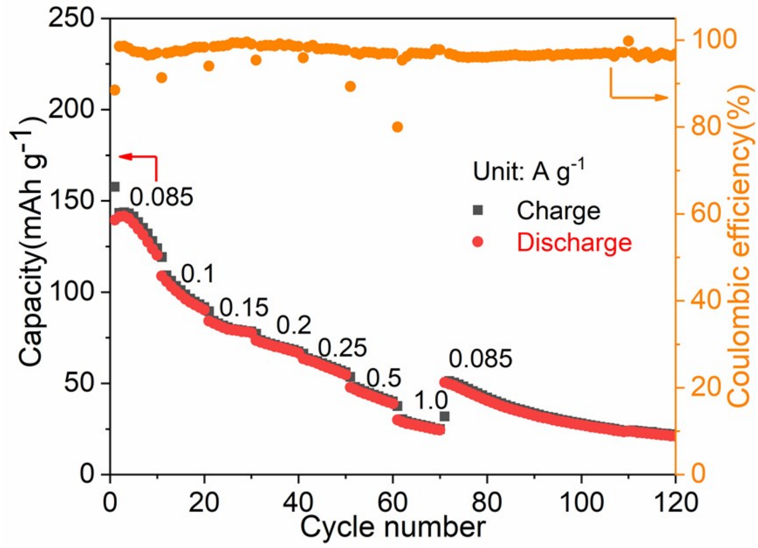

Figure. S8 Rate capabilities of NCSNC@C/CNT//$LiFePO_4$ full cells.

Cyclic capability list (lithium-ion battery)				
$Co_{0.85}Se$ based materials	Grain size (nm)	Cyclic performance (mAh g^{-1})		Ref
		Low current density	high current density	
$Co_{0.85}Se$ nanosheets	/	516 mAh g^{-1} at 0.2 A g^{-1} after 50 cycles (50 cycles in total)	/	1
$Co_{0.85}Se$ nanosheets@N-doped carbon nanosheets	/	636 mAh g^{-1} at 0.2 A g^{-1} after 100 cycles (100 cycles in total)	399 mAh g^{-1} at 5 A g^{-1} after 500 cycles (500 cycles in total)	2
$Co_{0.85}Se$ nanosheets/graphene	/	730 mAh g^{-1} at 0.5 A g^{-1} after 300cycles (300 cycles in total)	478.3 mAh g^{-1} at 1 A g^{-1} after 300 cycles (300 cycles in total)	3
$Co_{0.85}Se$@C/$Ti_3C_2T_x$ MXene	~29.9	700 mAh g^{-1} at 0.2 A g^{-1} after 270 cycles (270 cycles in total)	/	4
$Co_{0.85}Se$@N-doped reduced graphene oxide	~200	1471 mAh g^{-1} at 0.1 A g^{-1} after 60 cycles (100 cycles in total)	787.7 mAh g^{-1} at 2 A g^{-1} after 1000 cycles (1000 cycles in total)	5
$Co_{0.85}Se$ Nanoparticles Encapsulated by Nitrogen-Enriched Hierarchically Porous Carbon	~20	/	638.4 mAh g^{-1} at 1 A g^{-1} after 200 cycles (200 cycles in total)	6
This work	**~17**	**1582 mAh g^{-1} at 0.2 A g^{-1} after 80 cycles (100 cycles in total)**	**499 mAh g^{-1} at 1 A g^{-1} after 250 cycles (250 cycles in total)**	/

Table. S1 Comparison of the cyclic capabilities of $Co_{0.85}Se$ based LIB anode materials.

Rate capability list (lithium-ion battery)								
$Co_{0.85}Se$ based materials	Grain size (nm)	Rate capability (mAh g^{-1})						Ref
		0.1 A g^{-1}	0.2 A g^{-1}	0.5 A g^{-1}	1 A g^{-1}	2 A g^{-1}	5 A g^{-1}	
$Co_{0.85}Se$ nanosheets	/	675	645	574	493	374	/	1
$Co_{0.85}Se$ nanosheets@N-doped carbon nanosheets	/	/	802	694	496	378	252	2
$Co_{0.85}Se$ nanosheets/graphene	/	750	790	664.5	613.3	522.7	327.8	3
$Co_{0.85}Se@C/Ti_3C_2T_x$ MXene	~29.9	365.1	/	270.3	193.2	100.8	/	4
$Co_{0.85}Se$@N-doped reduced graphene oxide	~200	862.8	929	973.7	945.6	871.6	643.9	5
$Co_{0.85}Se$ Nanoparticles @Nitrogen-Enriched Hierarchically Porous Carbon	~20	696.1	657.3	632.4	585.9	511.8	401.7	6
This work	**~17**	**797**	**824**	**830**	**776**	**687**	**548**	/

Table. S2 Comparison of the Rate capabilities of $Co_{0.85}Se$ based LIB anode materials.

References

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