Synthesis of three-dimensional free-standing WSe_2/C hybrid nanofibers as anodes for high-capacity lithium/sodium ion batteries

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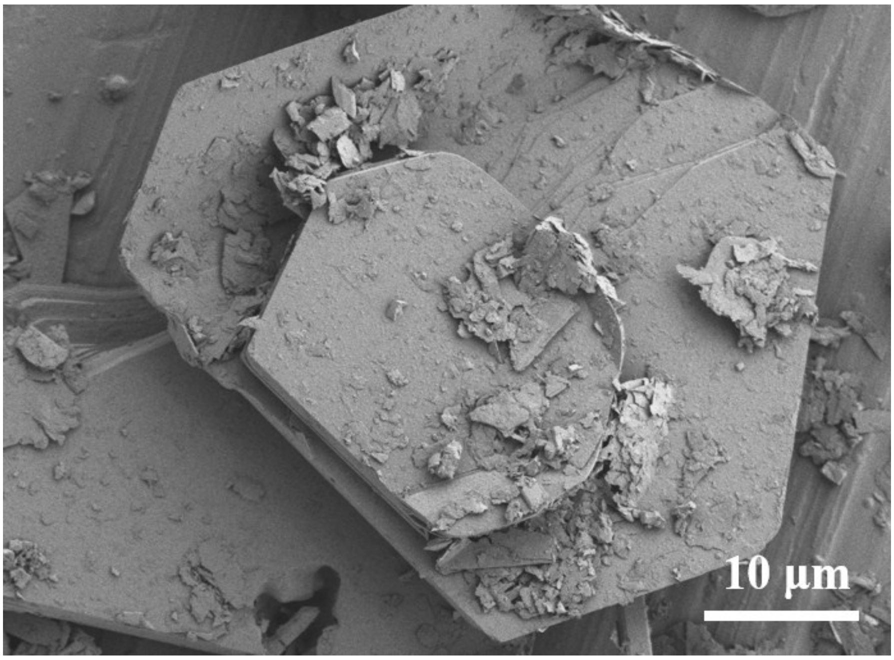

Fig. S1 The SEM image of bulk WSe_2-C composites.

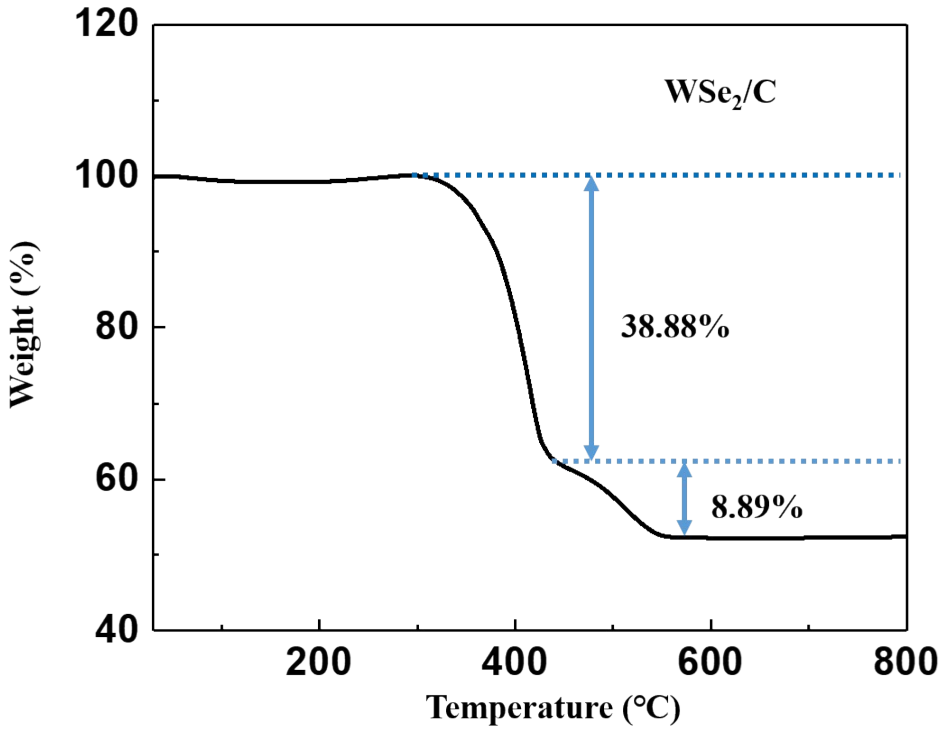

Fig. S2 TGA curve of WSe_2/C nanofibers from 25 ℃ to 800 ℃ with a rate of 10 ℃ min^{-1} under air.

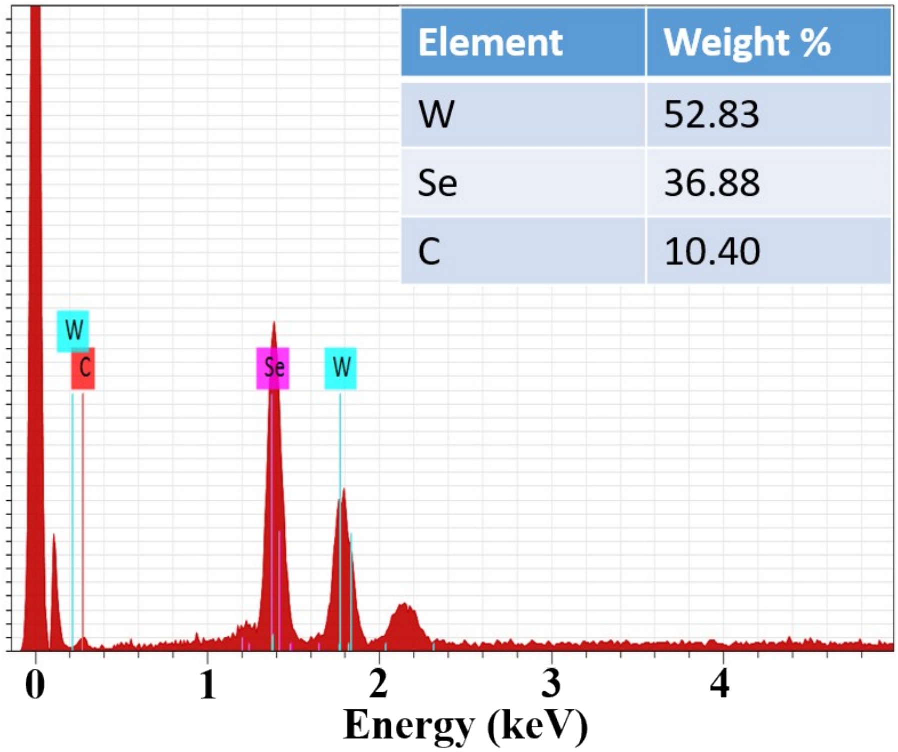

Fig. S3 The EDS spectrum of the B-WSe_2-C.

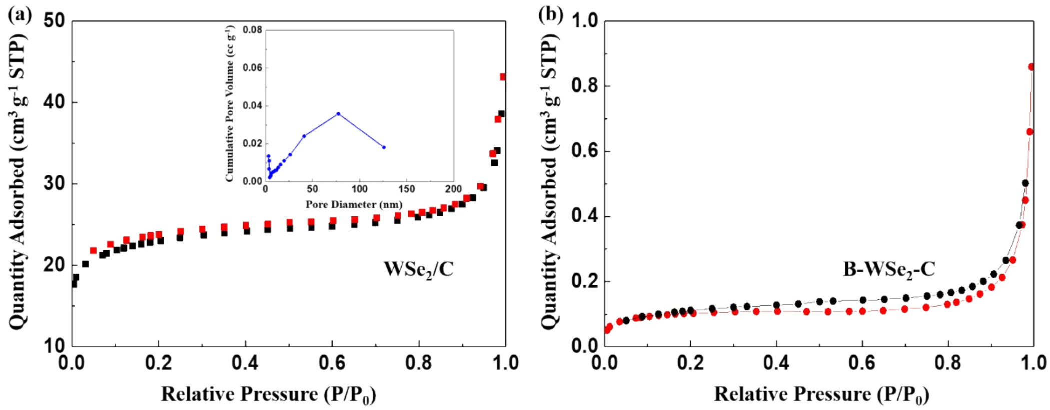

Fig. S4 The N_2 adsorption and desorption isotherms of (a) WSe_2/C composites and (b) B-WSe_2-C. Inset image in (a) is the pore-size distribution curve of the WSe_2/C nanofibers.

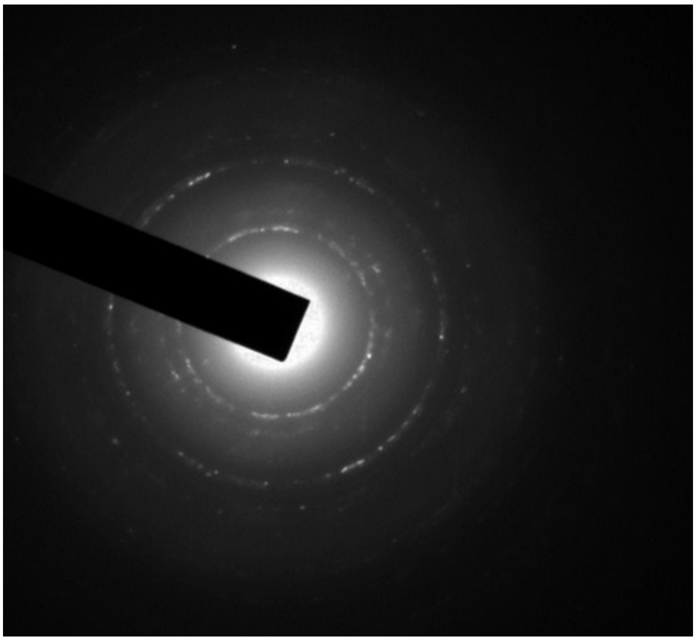

Fig. S5 The SAED pattern of WSe_2/C nanofibers before lithiation.

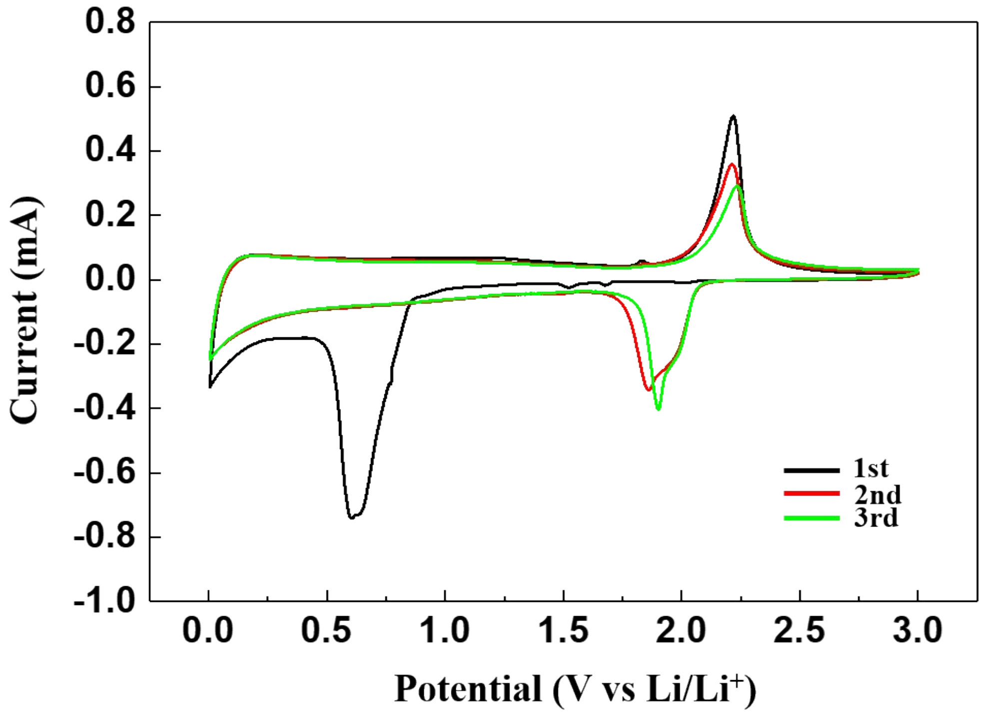

Fig. S6 The CV curves of B-WSe_2-C electrode in initial three cycles with a scan rate of 0.1 mV s^{-1}.

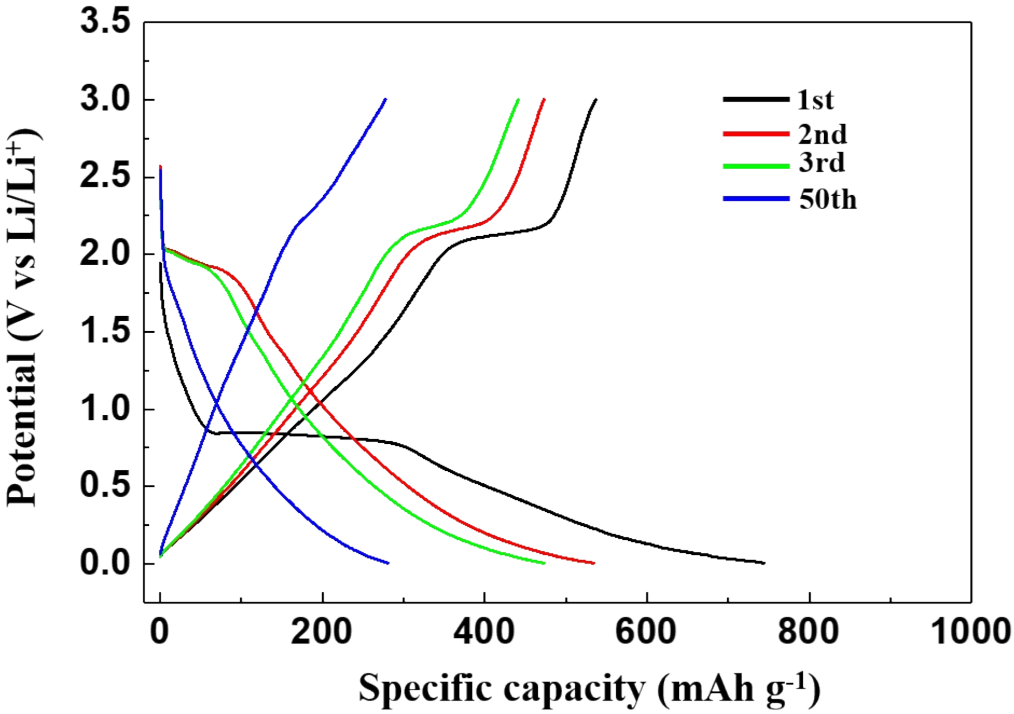

Fig. S7 The charge-discharge curves of the B-WSe_2-C in the voltage range of 0.005-3 V vs Li/Li^+ at a scan rate of 0.1 mV s^{-1}.

Materials	Current density (A g^{-1})	Cycle number	Capacity (mAh g^{-1})	References
WSe_2	0.03	30	400	S1
WSe_2	1	1500	224.9	S2
WSe_2/CMK-5	0.5	600	490	S3
WSe_2/rGO	0.063	80	528	S4
1T@2H WS_2@CFC	2	800	510	S5
NDG-MoS_2-NDG	1	600	552	S6
MoS_2-$MoSe_2$@C	0.1	100	680	S7
$MoSe_2$/N-C	8	200	277	S8
ReS_2/N-CNFs	0.1	400	440	S9
WSe_2/C	0.1	100	608.3	This work
	25	10000	257	

Table. S1 Comparison of the lithium storage performance of our work to other transition metal dichalcogenides.

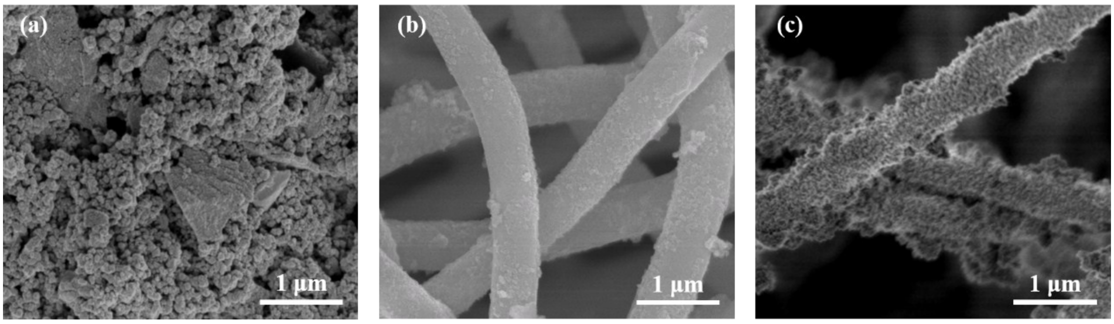

Fig. S8 SEM images of (a) the B-WSe_2-C composites after 10 cycles at current density of 0.1 A g^{-1} (b) WSe_2/C nanofibers after 10 cycles at a current density of 0.1 A g^{-1}. (c) The SEM image of WSe_2/C after 2000 cycles at a current density of 25 A g^{-1}.

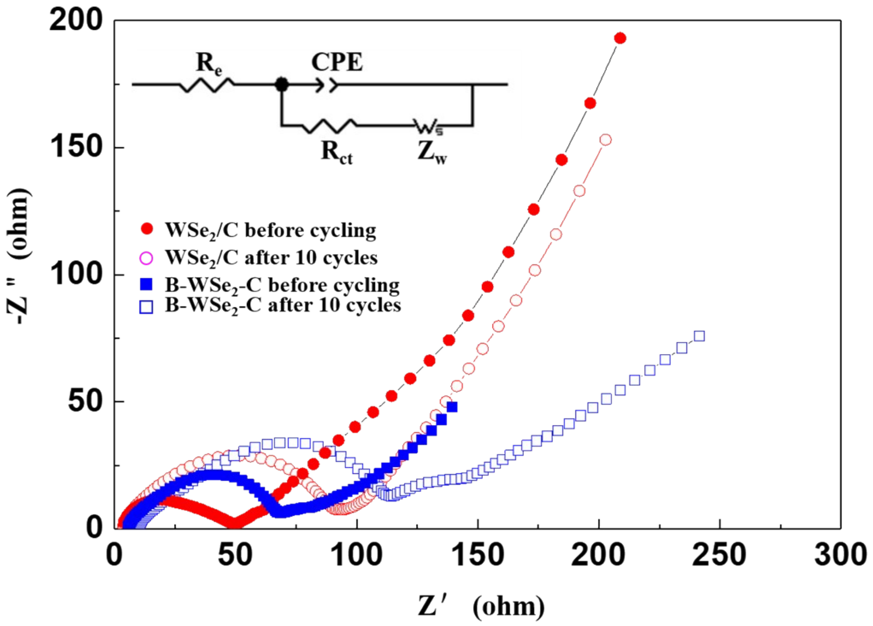

Fig. S9 Electrochemical impedance spectroscopy of WSe_2/C and B-WSe_2-C electrodes before and after cycling. The inset image is the equivalent circuit of the system.

Sample	R_e (Ω)	R_{ct} (Ω)
WSe_2/C before cycling	1.05	47.55
WSe_2/C after 10 cycles	2.76	90.42
B-WSe_2-C before cycling	5.95	61.17
B-WSe_2-C after 10 cycles	9.50	111.80

Table. S2 The fitted parameters of the R_e and R_{ct} of the WSe_2/C and B-WSe_2-C.

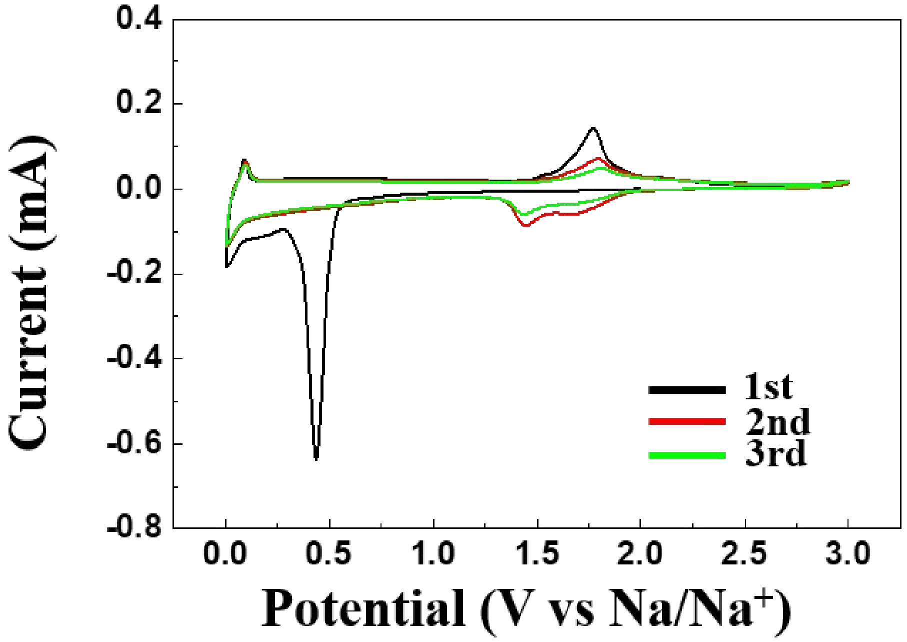

Fig. S10 The CV curves of the B-WSe_2-C in the voltage range of 0.005-3 V vs Na/Na^+ at a scan rate of 0.1 mV s^{-1}.

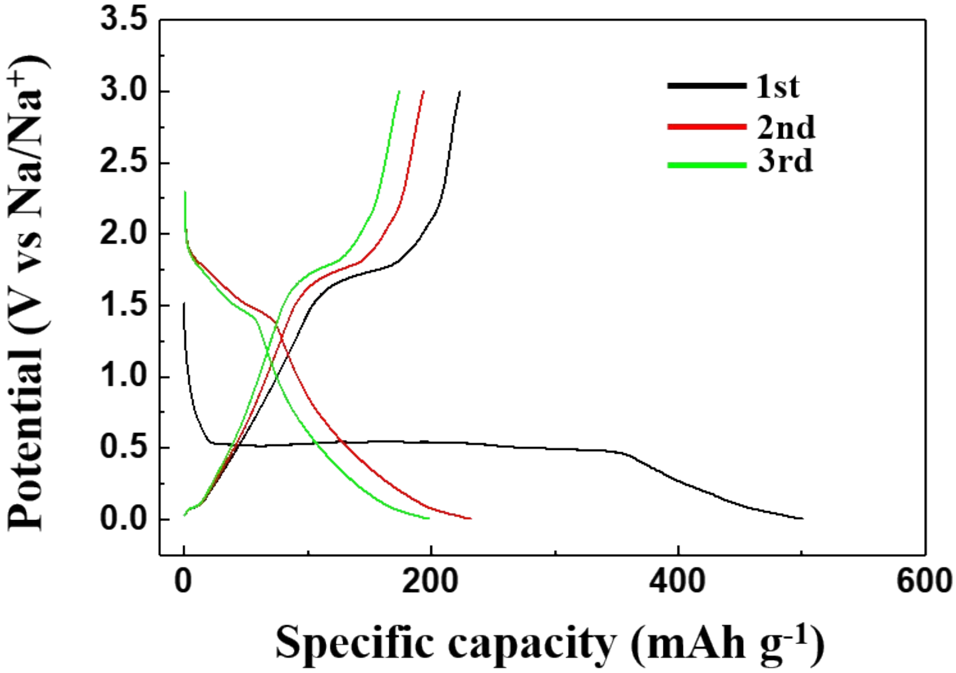

Fig. S11 The discharge-charge curves of B-WSe_2-C in a potential range of 0.005-3 V vs Na/Na^+.

Materials	Current density (A g^{-1})	Cycle number	Capacity (mAh g^{-1})	References
WSe_2	0.02	30	190	S10
WSe_2	0.4	50	400	S11
WSe_2/C	0.2	50	270	S12
1T MoS_2/Graphene	0.05	200	313	S13
$MoSe_2$/N-C	0.1	120	552.1	S14
WS_2/CNT-rGO	0.2	100	252.9	S15
VS_2-SNSs	0.2	100	245	S16
ReS_2	0.1	800	245	S17
NbS_2	0.5	100	157	S18
WSe_2/C	0.1	100	257.8	**This work**

Table. S3 Comparison of the sodium storage properties of our materials with reported transition metal dichalcogenides.

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