Electronic Supplementary Information (ESI)

Highly flexible free-standing Sb/Sb_2O_3@N-doped carbon nanofibers membranes for sodium ion batteries with excellent stability

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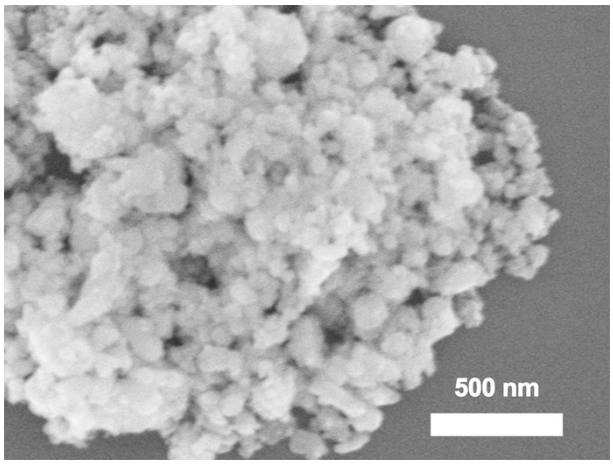

Fig S1. The SEM image of Sb_2O_3 after ultrasonification treatment.

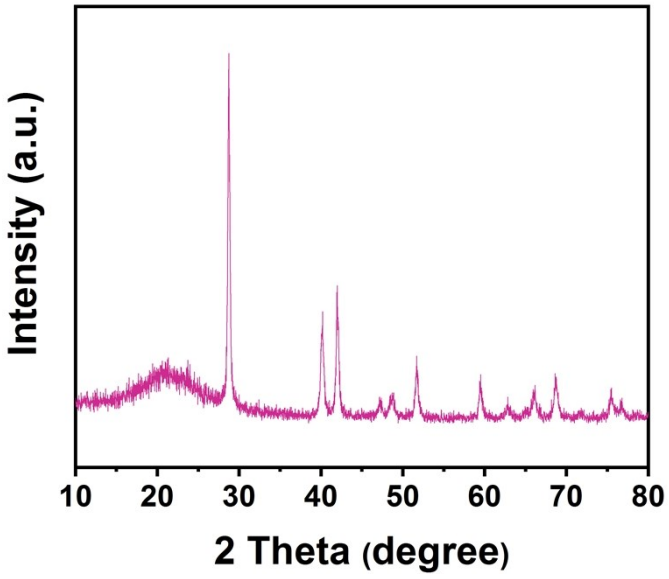

Fig S2. XRD patterns of Sb@C.

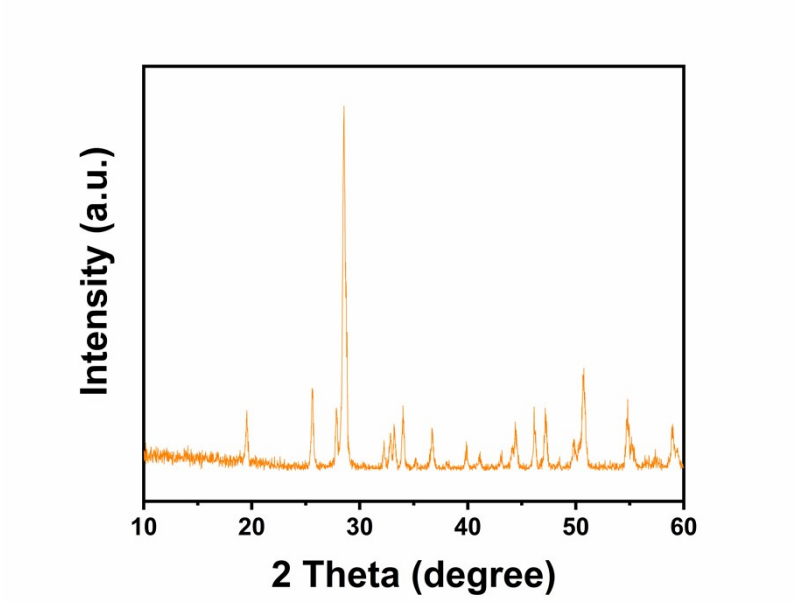

Fig S3. XRD patterns of pristine Sb_2O_3.

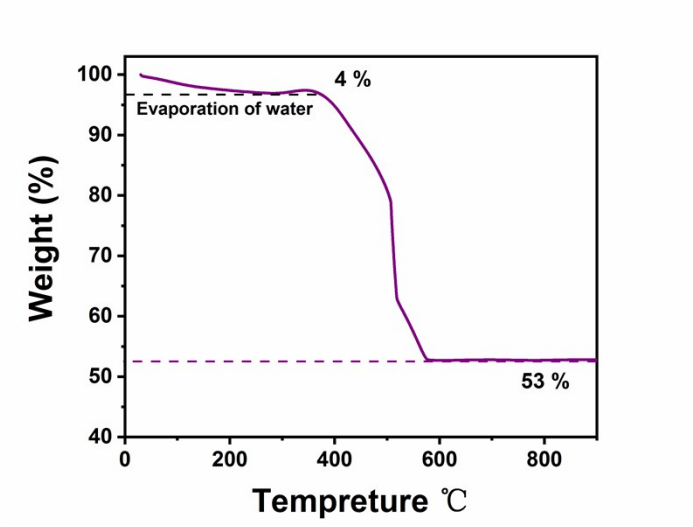

Fig S4. The TGA spectra of Sb/Sb_2O_3@NCNFs.

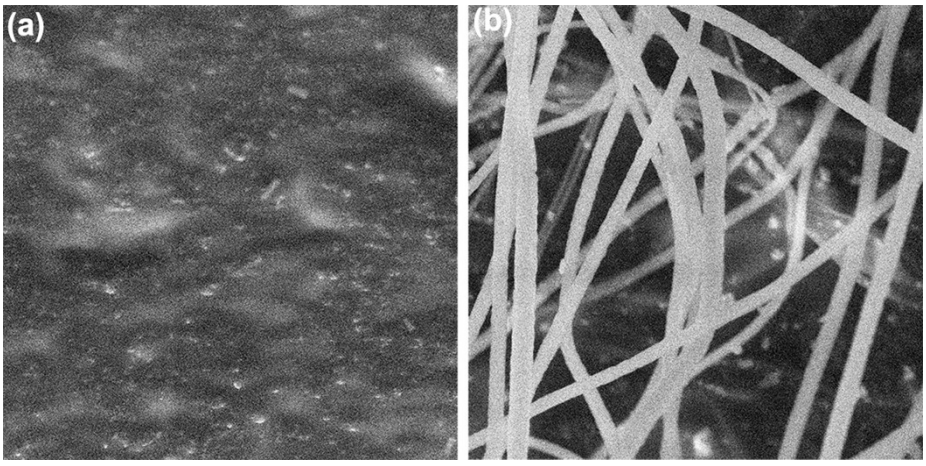

Fig S5. SEM image of (a) Sb@C and (b) NCNFs.

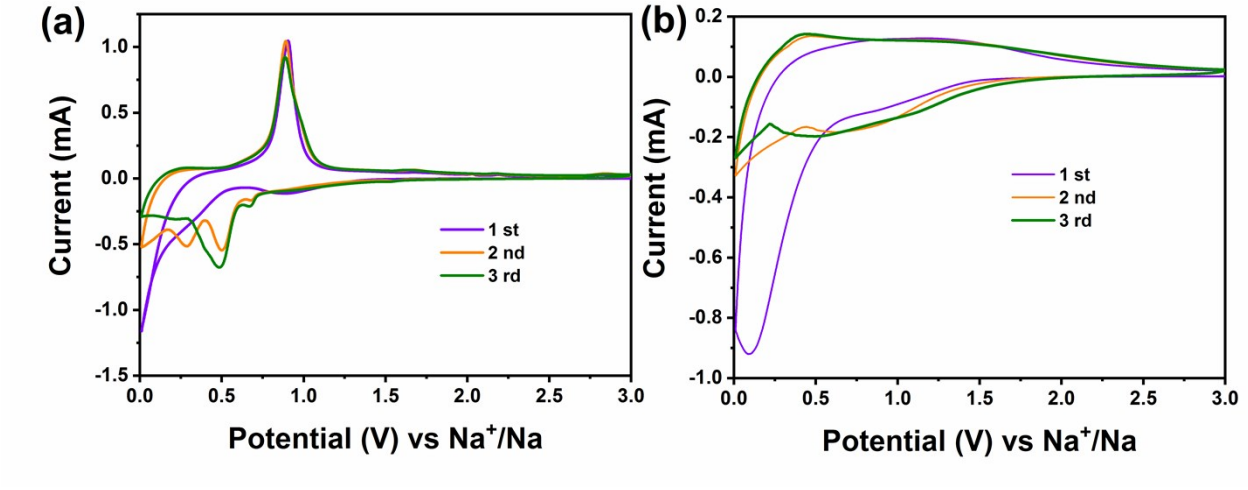

Fig S6. CV curves of (a) Sb@C and (b) NCNFs.

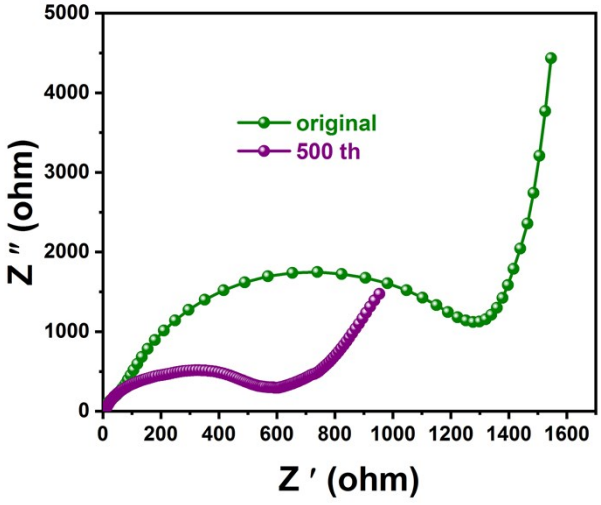

Fig S7. The EIS curves of original and after cycles for Sb/Sb_2O_3@NCNFs.

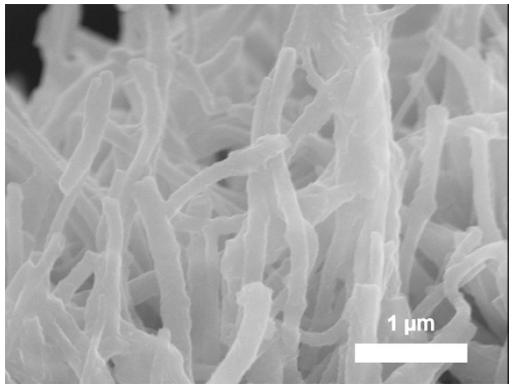

Fig S8. The SEM image of Sb/Sb_2O_3@NCNFs after cycles.

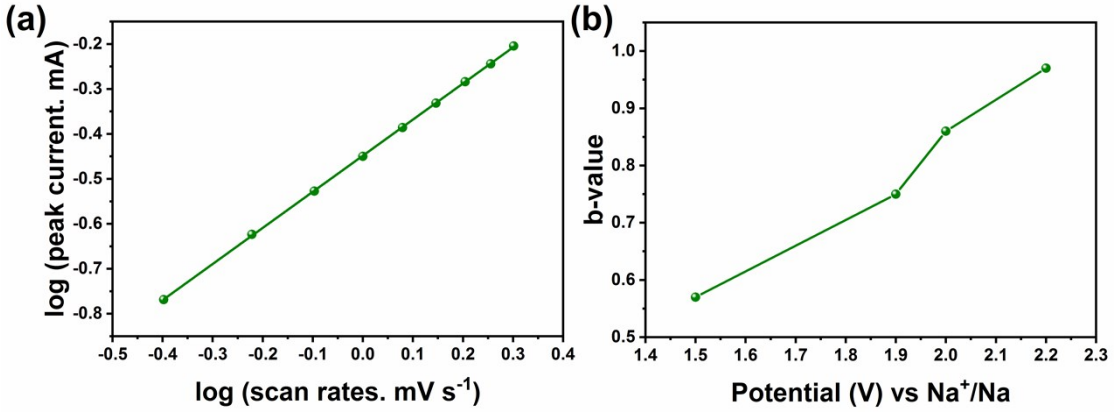

Fig S9. (a) log (peak current) vs. log (scan rates) plots of Sb/Sb_2O_3@NCNFs, (b) calculated b-values for Sb/Sb_2O_3@NCNFs at different potential.

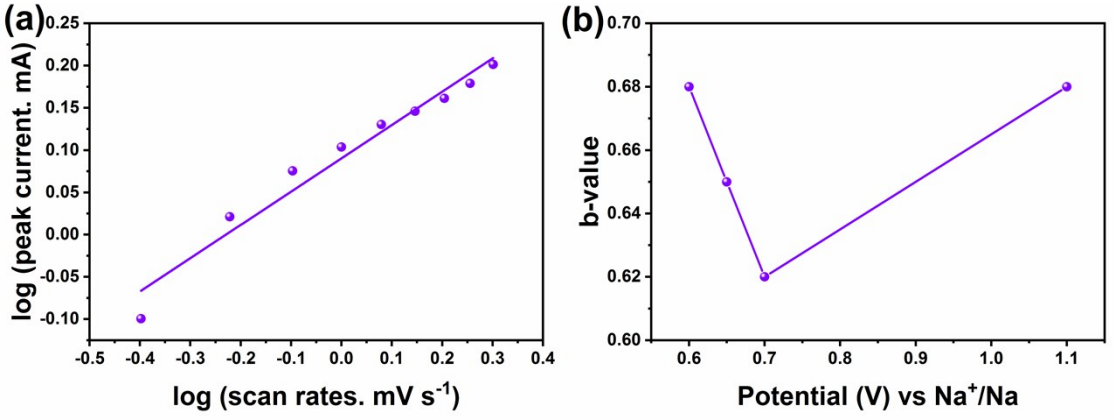

Fig S10. (a) log (peak current) vs. log (scan rates) plots of Sb@C, (b) calculated b-values for Sb@C at different potential.

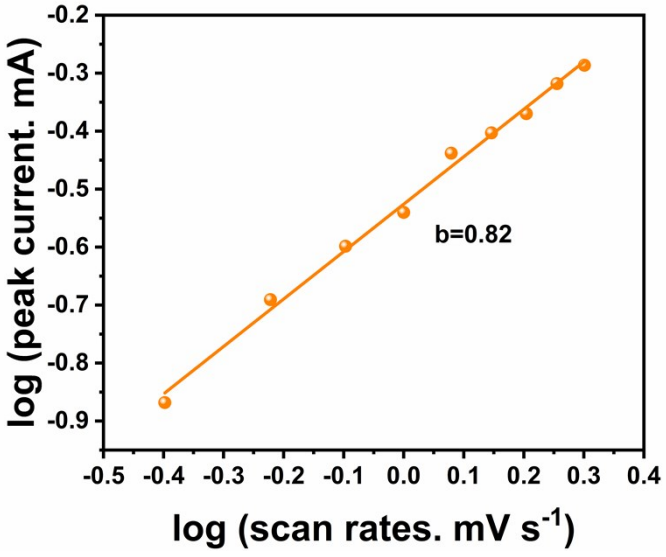

Fig S11. log (peak current) vs. log (scan rates) plots of NCNFs.

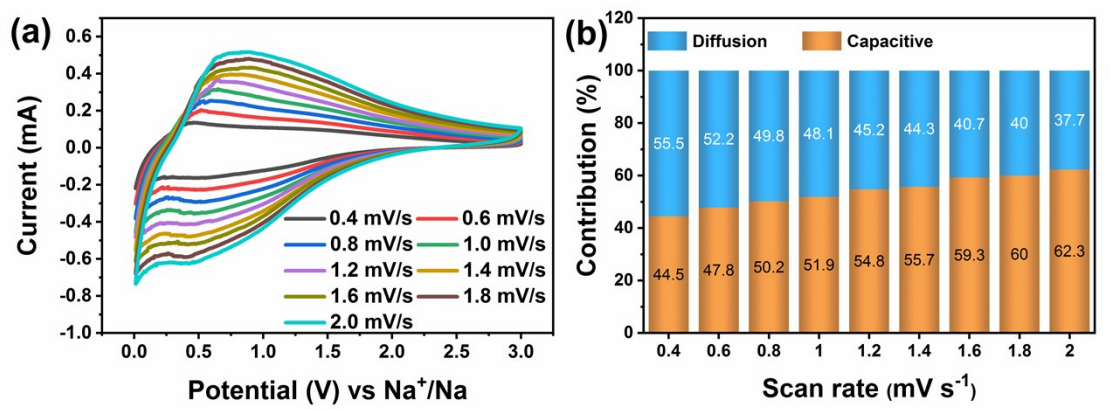

Fig S12. (a) CV curves of NCNFs at various scan rates, (b) The percentage of capacitive- and diffusion-controlled contribution at various scan rates.

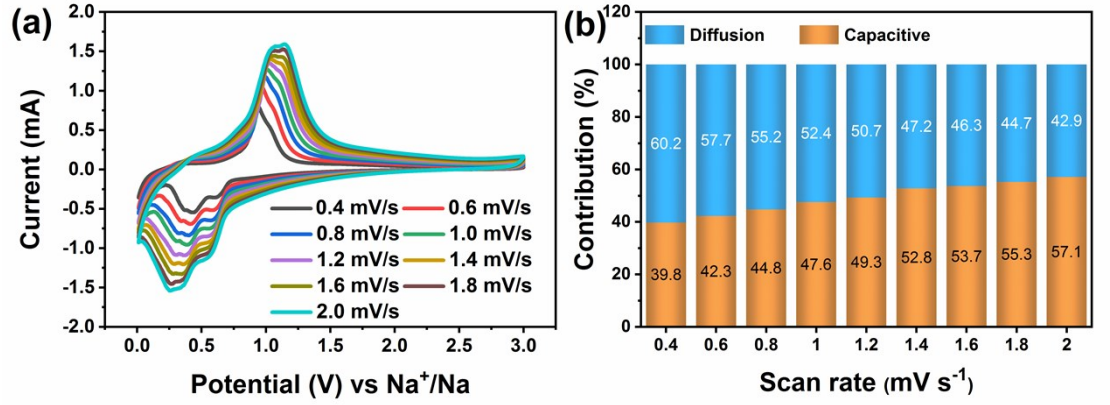

Fig S13. (a) CV curves of Sb@C at various scan rates, (b) The percentage of capacitive- and diffusion-controlled contribution at various scan rates.

Table S1. The element contents of Sb/Sb_2O_3@NCNFs according to XPS.

Element	Sb/Sb_2O_3@NCNFs
	Atomic%
C	56.71
N	9.87
O	29
Sb	4.42

Table S2. The element contents of Sb/Sb_2O_3@NCNFs according to EDS.

Element	Sb/Sb_2O_3@NCNFs	
	Atomic%	Wt%
C	67.13	46.25
N	9.51	7.64
O	19.29	17.7
Sb	4.07	28.41

Table S3. Summary of the Antimony-based materials for SIBs

Materials	Current density (A g^{-1})	Cycle number	Reversible capacity (mAh g^{-1})	Reference
Sb/Sb_2O_3@NCNFs	0.1/1	100/700	527.3/400	This work
Sb-C nanofibers	0.2	400	446	1
Sb/Sb_2O_3–PPy	0.066	100	512.01	2
3D Ni/NiSb/Sb_2O_3	0.2	100	410	3
Sb/SbO_x/RGO	0.05	100	311.6	4
Sb@C	0.1	240	407	5
Sb/Sb_2O_3	0.66	180	540	6
SbNP@C	0.1	300	350	7
C@Sb	1	700	386.3	8
Sb_2O_3/Sb@graphene–CSN	0.1	200	491	9

References

(1) L. Wu, X. Hu, J. Qian, F. Pei, F. Wu, R. Mao, X. Ai, H. Yang, Y. Cao, *Energy Environ. Sci*. 2014, **7**, 323-328.
(2) D. H. Nam, K. S. Hong, S. J. Lim, M. J. Kim and H. S. Kwon, *Small* 2015, **11**, 2885-2892.
(3) S. Kim, S. Qu, R. Zhang and P. Braun, *Small* 201900258.
(4) G. Wang, J. Feng, L. Dong, X. Li, D. Li, *J. Alloys Compd* 2017, **693**, 141-149.
(5) Z. Liu, X. Y. Yu, X. W. Lou and U. Paik, *Energy Environ. Sci* 2016, **9**, 2314-2318.
(6) J. Pan, N. Wang, Y. Zhou, X. Yang, W. Zhou, Y. Qian and J. Yang, *Nano Res* 2017, **10**, 1794-1803.
(7) Y. Zhu, X. Han, Y. Xu, Y. Liu, S. Zheng, K. Xu, L. Hu, and C. Wang, *ACS nano* 2013, **7**, 6378-6386.
(8) W. Zhao, L. Zou, X. Ma, W. Zhang, Y. Li, G. Wang, P. Zhang and L. Xia, *Electrochim. Acta* 2019, **300**, 396-403.
(9) N. Li, S. Liao, Y. Sun, H. W. Song and C. X. Wang, *J. Mater. Chem. A* 2015, **3**, 5820-5828.