Supplementary Information

In-situ synthesized SnSe nanorods in SnO_x@CNFs membrane toward high-performance freestanding and binder-free lithium-ion batteries

Haocheng Yuan, [a] Yuqiang Jin, [a] Jinle Lan, [a,*] Yuan Liu, [b] Yunhua Yu, [a,*] and Xiaoping Yang [a]

a State Key Laboratory of Organic−Inorganic Composites, College of Materials Science and Engineering, Beijing University of Chemical Technology, Beijing 100029, China.

b State Key Lab of New Ceramics and Fine Processing, School of Materials Science and Engineering, Tsinghua University, Beijing 100084, China.

Corresponding author: lanjl@mail.buct.edu.cn, yuyh@ mail.buct.edu.cn.

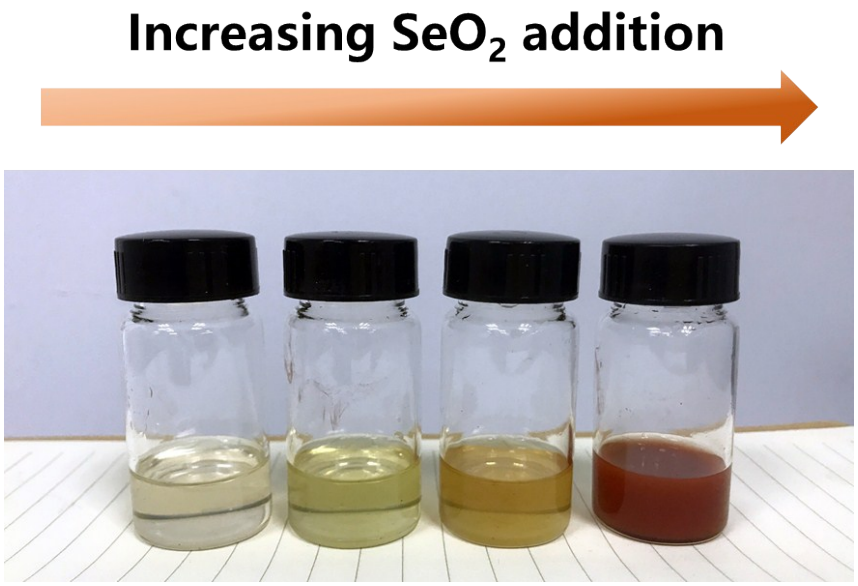

Fig. S1 Photograph of polymer precursor solution with different SeO_2 addition

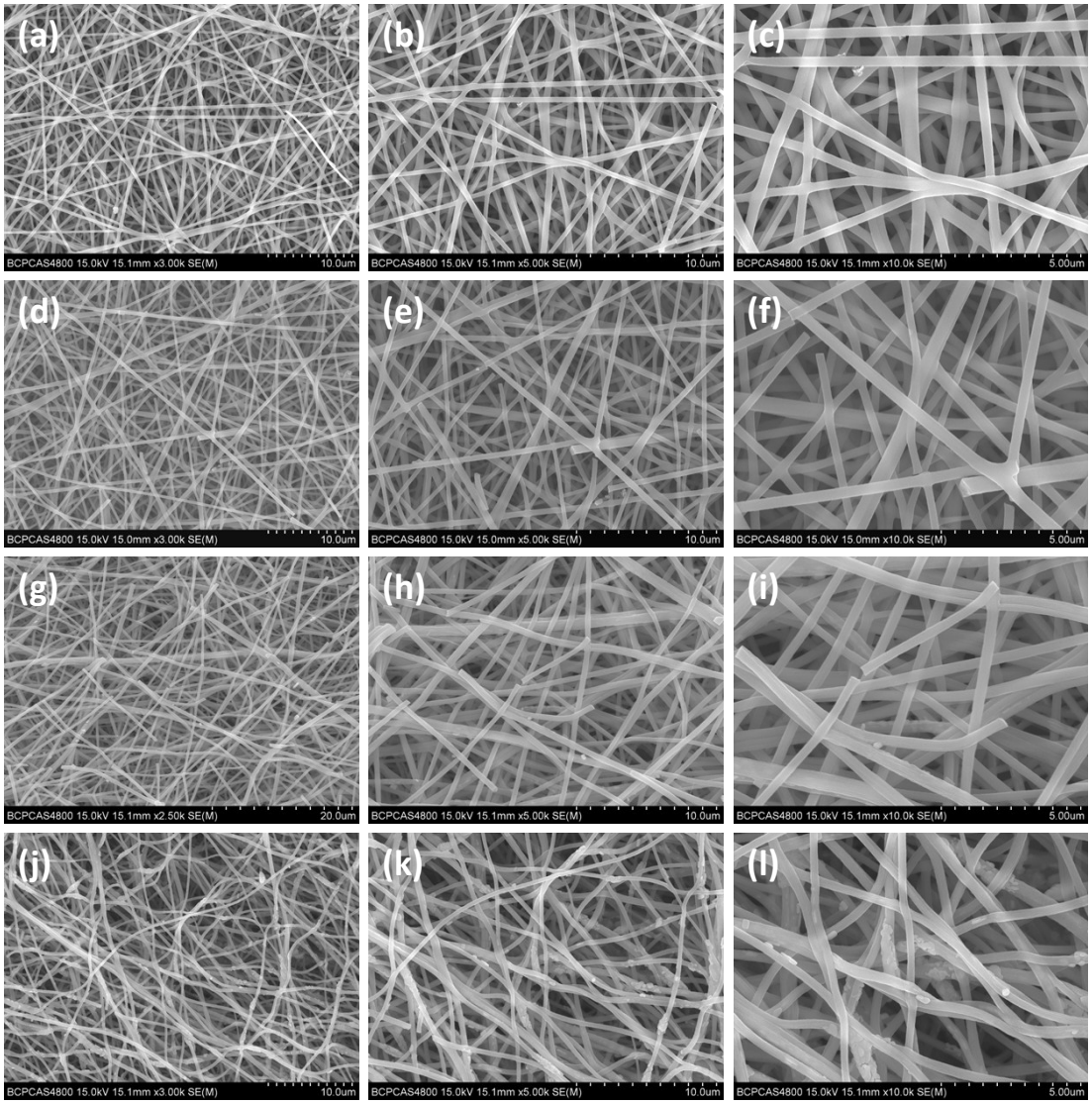

Fig. S2 SEM images of (a-c) SnO_x@CNFs, (b-f) 10-SnSe/SnO_x@CNFs, (h-i) 20-SnSe/SnO_x@CNFs and (j-l) 30-SnSe/SnO_x@CNFs.

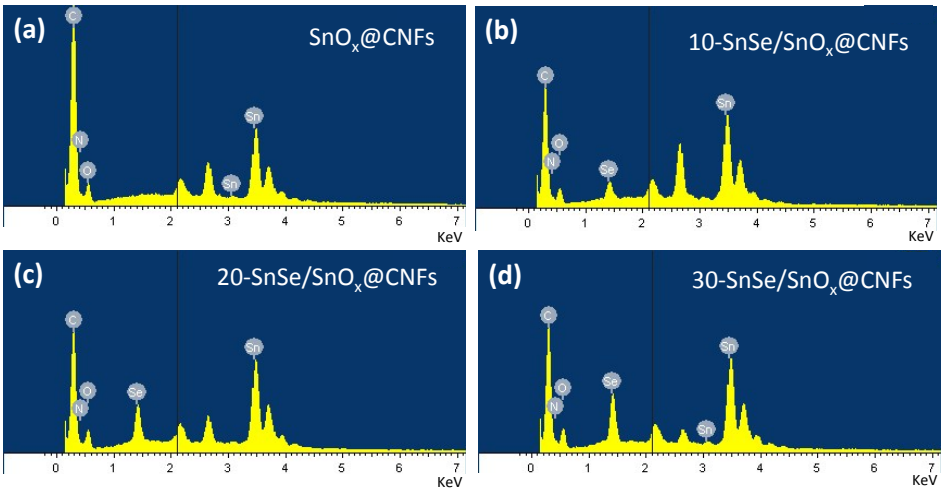

Fig. S3 EDS spectrum of (a)SnO_x@CNFs, (b)10-SnSe/SnO_x@CNFs, (c)20-SnSe/SnO_x@CNFs and (d)30-SnSe/SnO_x@CNFs

Table S1 The atomic percent of C, N, O, Sn, Se and The atomic ratio of Se to Sn in different samples

	C (%)	N (%)	O (%)	Sn (%)	Se (%)	Se/Sn
SnO_x@CNFs	66.83	10.91	17.02	5.24		
10-SnSe/SnO_x@CNFs	62.87	7.83	20.03	8.18	1.09	0.13
20-SnSe/SnO_x@CNFs	66.20	3.66	20.69	7.40	2.06	0.27
30-SnSe/SnO_x@CNFs	61.14	10.87	18.89	6.77	2.33	0.34

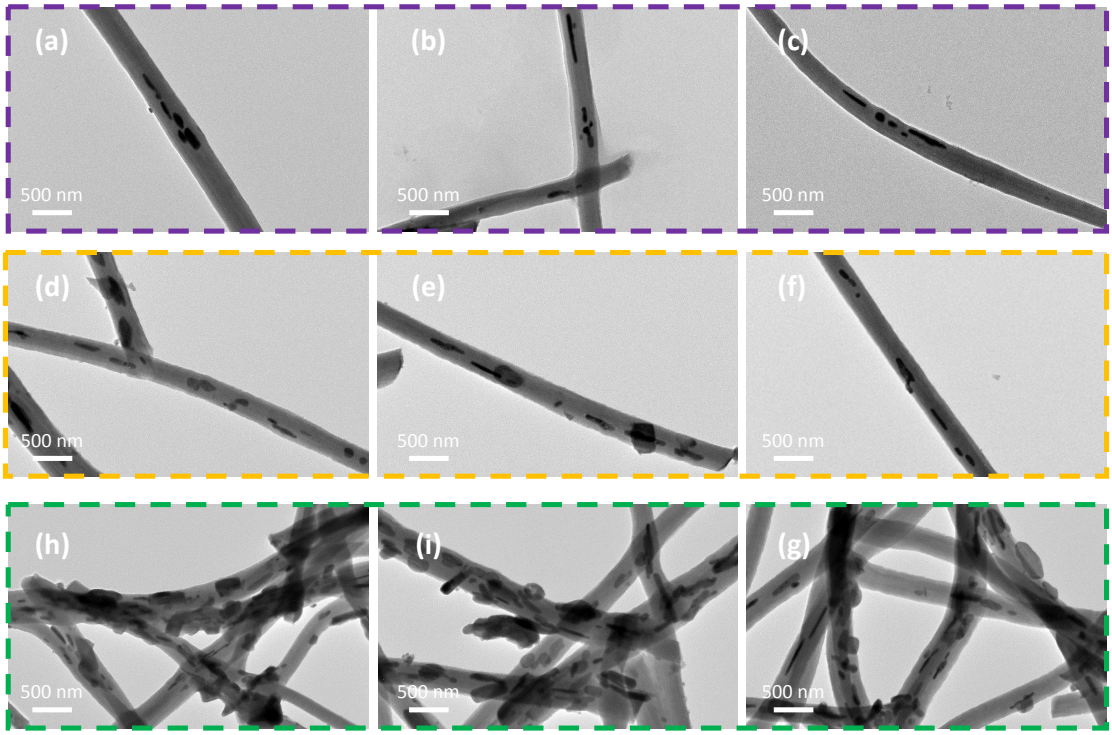

Fig. S4 TEM images of (a-c)10-SnSe/SnO_x@CNFs, (b-f) 20-SnSe/SnO_x@CNFs and (h-g) 30-SnSe/SnO_x@CNFs at different positions.

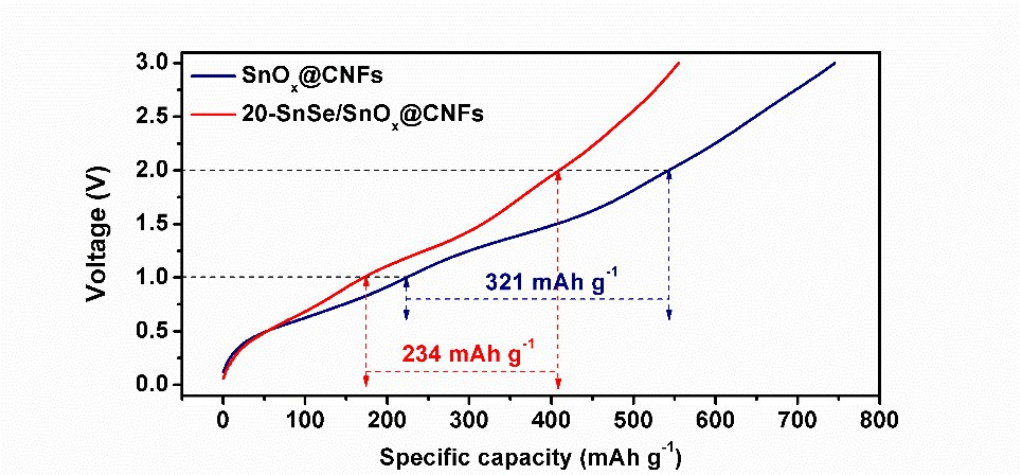

Fig. S5 The charge capacity comparison for SnO_x@CNFs and 20-SnSe/SnO_x@CNFs in 1.0 V - 2.0 V at 50th cycle.

Table S2 calculated specific capacity of all samples

Materials	Thickness (μm)	Areal loading (mg cm^{-2})	Areal capacity (mAh cm^{-2})	Volumetric capacity (mAh cm^{-3})
SnO_x@CNFs	8	0.57	0.28	348
10-SnSe/SnO_x@CNFs	15	0.80	0.54	360
20-SnSe/SnO_x@CNFs	27	1.73	1.28	474
30-SnSe/SnO_x@CNFs	30	1.87	1.22	407

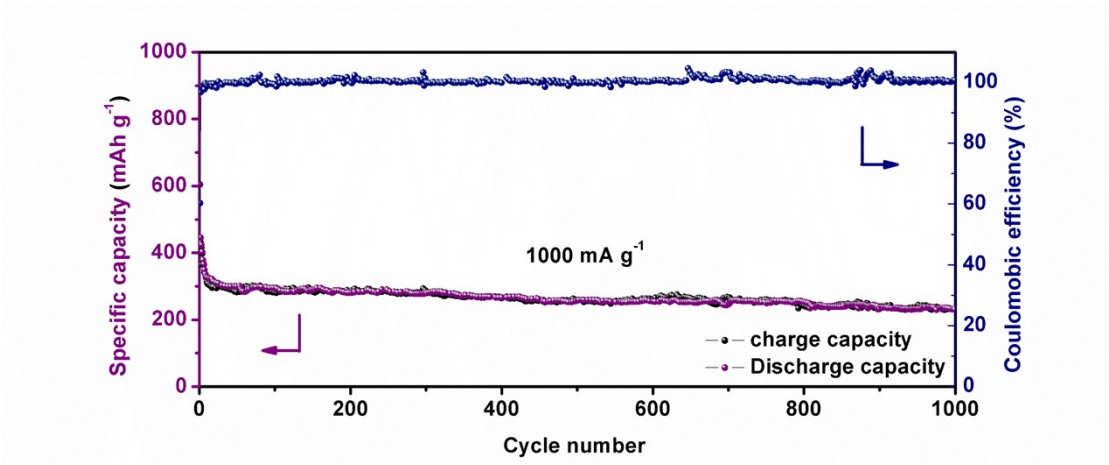

Fig. S6 Long cycle test for SnO_x@CNFs at 1000 mA g^{-1}

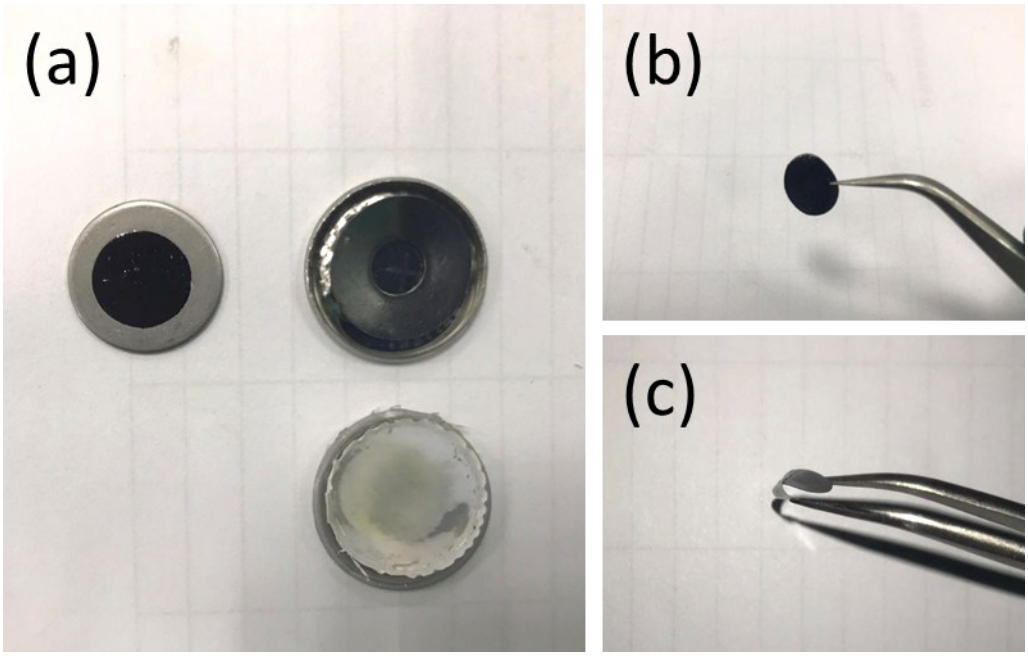

Fig. S7 optical photograph of 20-SnSe/SnO_x@CNFs electrode after 100 cycles

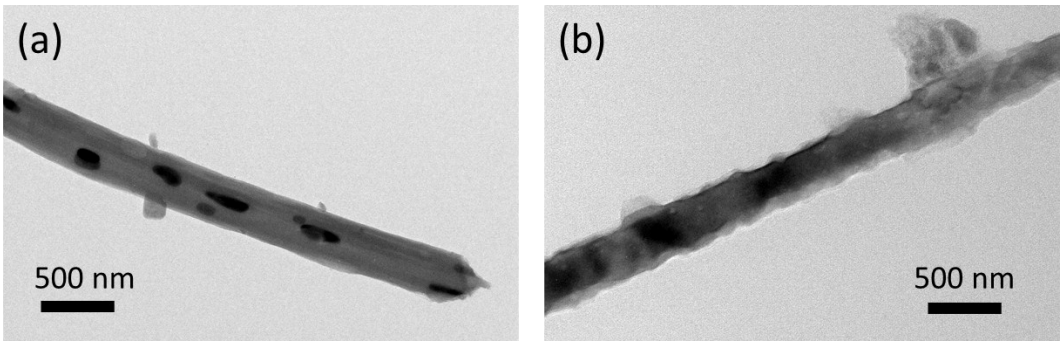

Fig. S8 TEM image of 20-SnSe/SnO_x@CNFs before (a) and after (b) 100 cycles at 1 A g^{-1}.

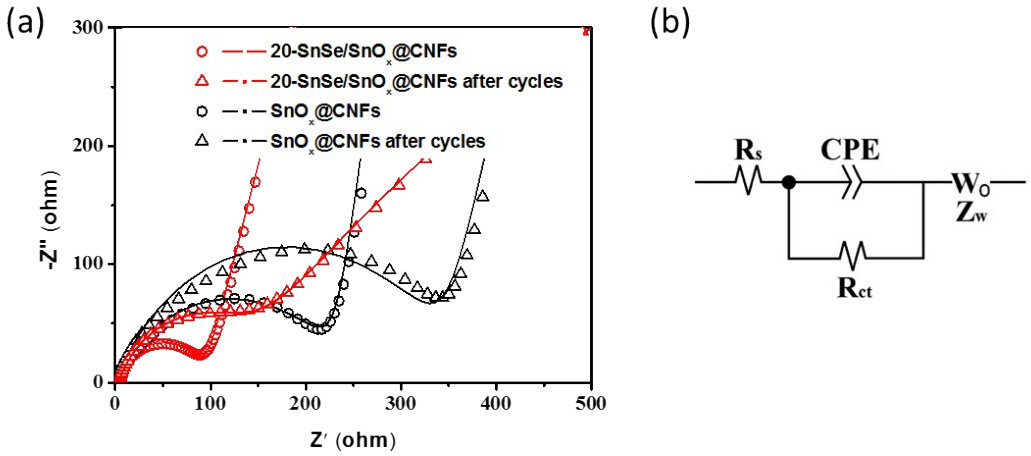

Fig. S9 (a) EIS and fitting line for of SnO_x@CNFs and 20-SnSe/SnO_x@CNFs. (b) The equivalent circuits used to fit the Nyquist plots.