Supporting Information

Foldable Potassium-Ion Batteries Enabled by Free-standing and Flexible SnS_2@C Nanofibers

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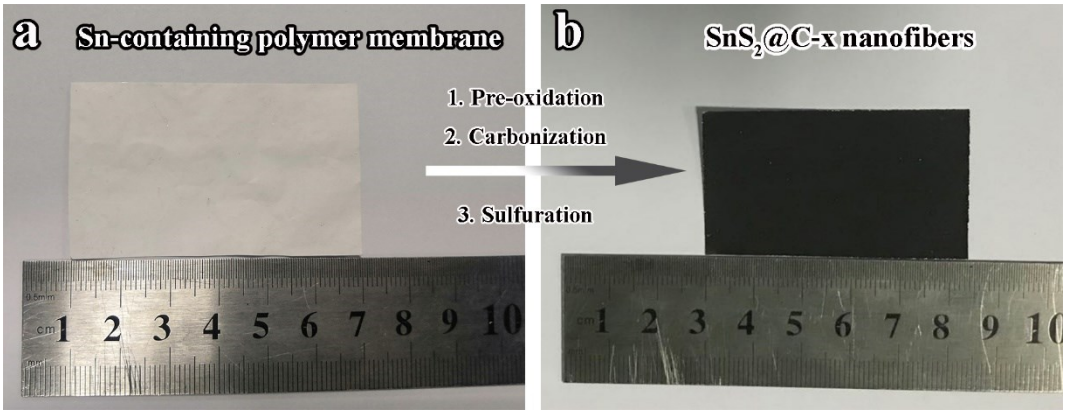

Figure S1. Digital photos of (a) Sn-containing polymer membrane and (b) SnS_2@C-x nanofibers.

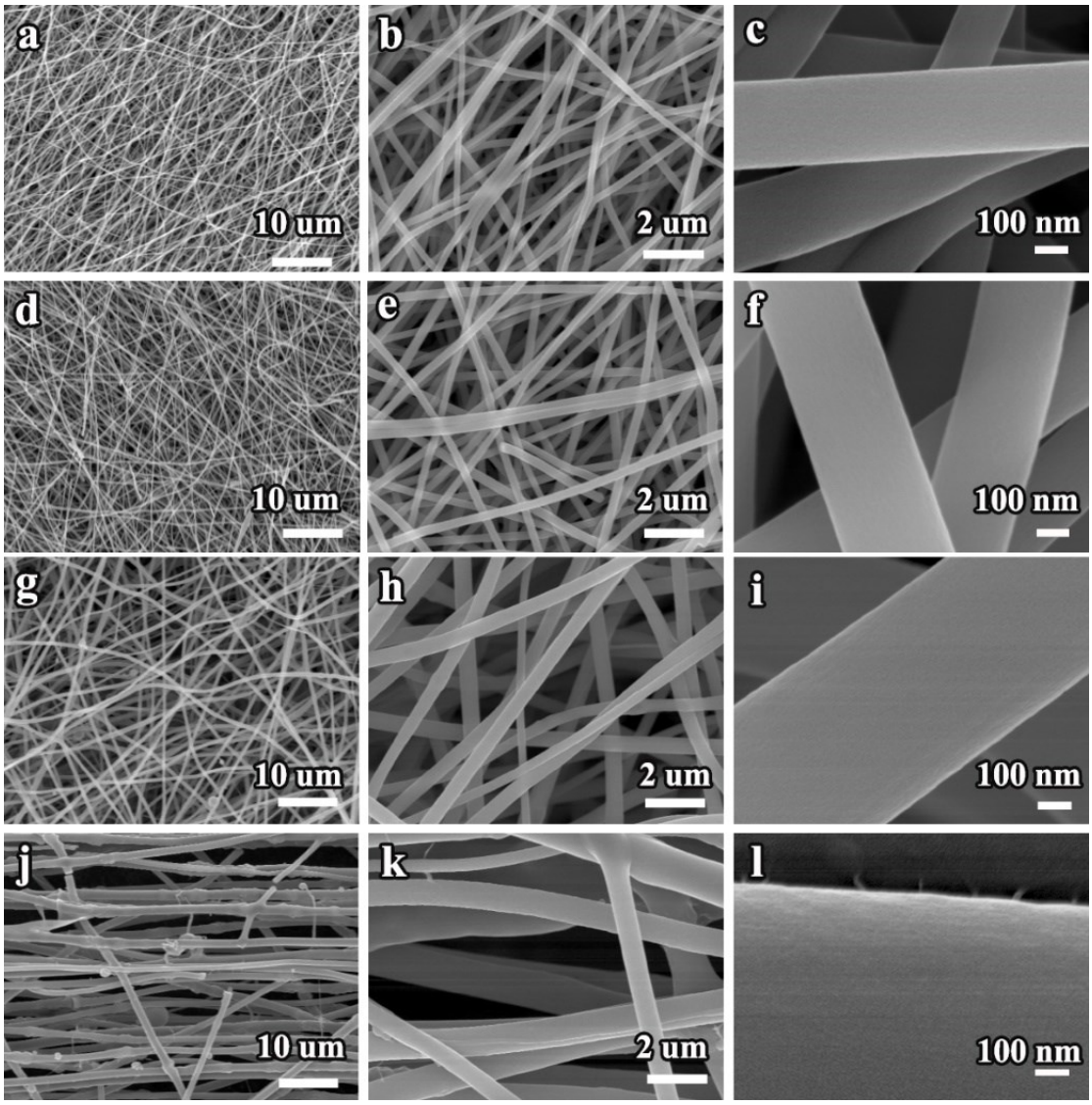

Figure S2. SEM images of Sn@C-x nanofibers. (a-c) Sn@C-1, (d-f) Sn@C-2, (g-i) Sn@C-3 and (j-l) Sn@C-4.

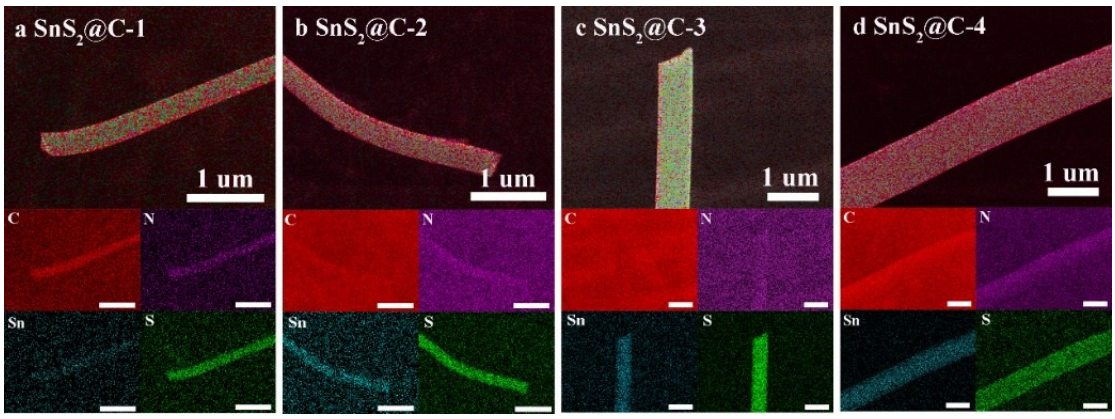

Figure S3. EDS mapping results of SnS2@C-x nanofibers (C, N, Sn and S). (a) SnS_2@C-1, (b) SnS_2@C-2, (c) SnS_2@C-3 and (d) SnS_2@C-4.

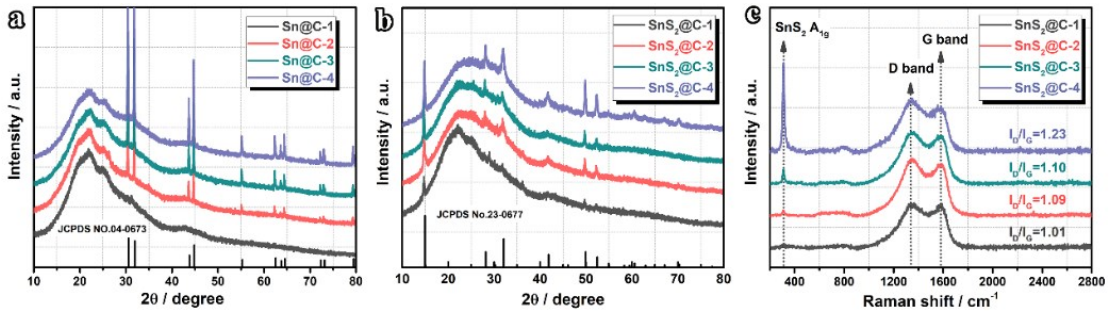

Figure S4. Structural analyses. XRD patterns of (a) Sn@C-x and (b) SnS2@C-x nanofibers. (c) Raman spectra of SnS_2@C-x nanofibers.

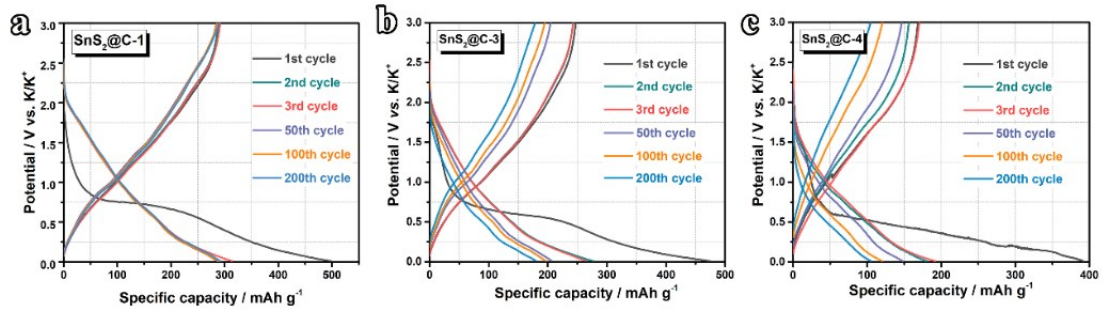

Figure S5. Charge-discharge curves of (a) SnS_2@C-1, (b) SnS_2@C-3 and (c) SnS_2@C-4 electrodes.

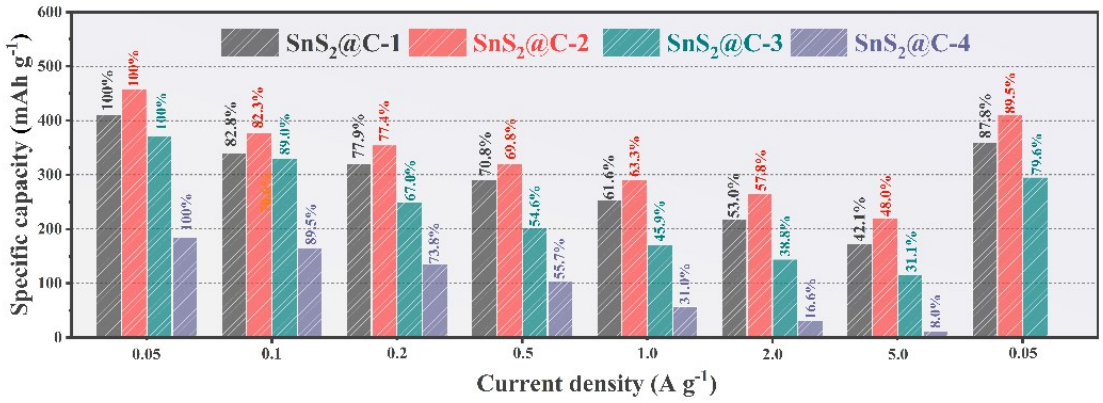

Figure S6. Capacity retention ratios at various current densities.

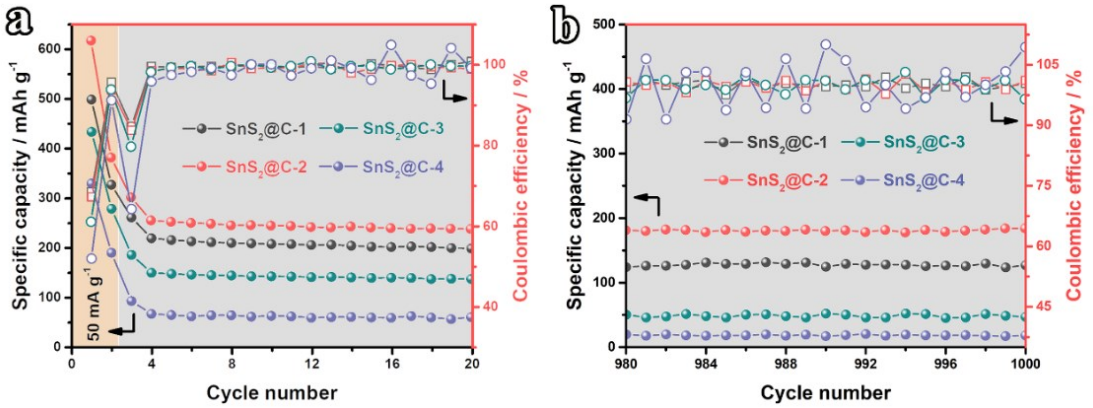

Figure S7. Long-term cycling test (magnified plots of **Figure 4d**). (a) the initial 20 cycles and (b) the last 20 cycles.

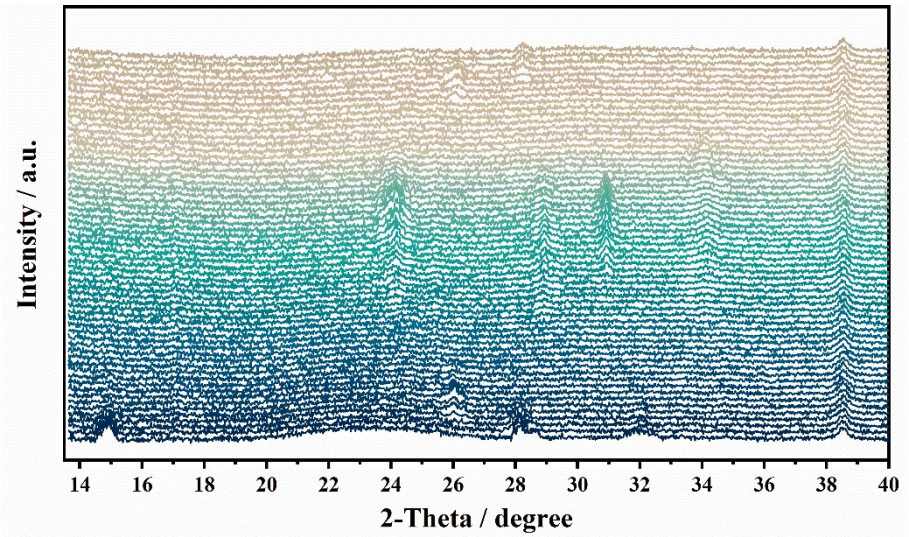

Figure S8. *In situ* XRD results (raw data for plotting **Figure 5a**).

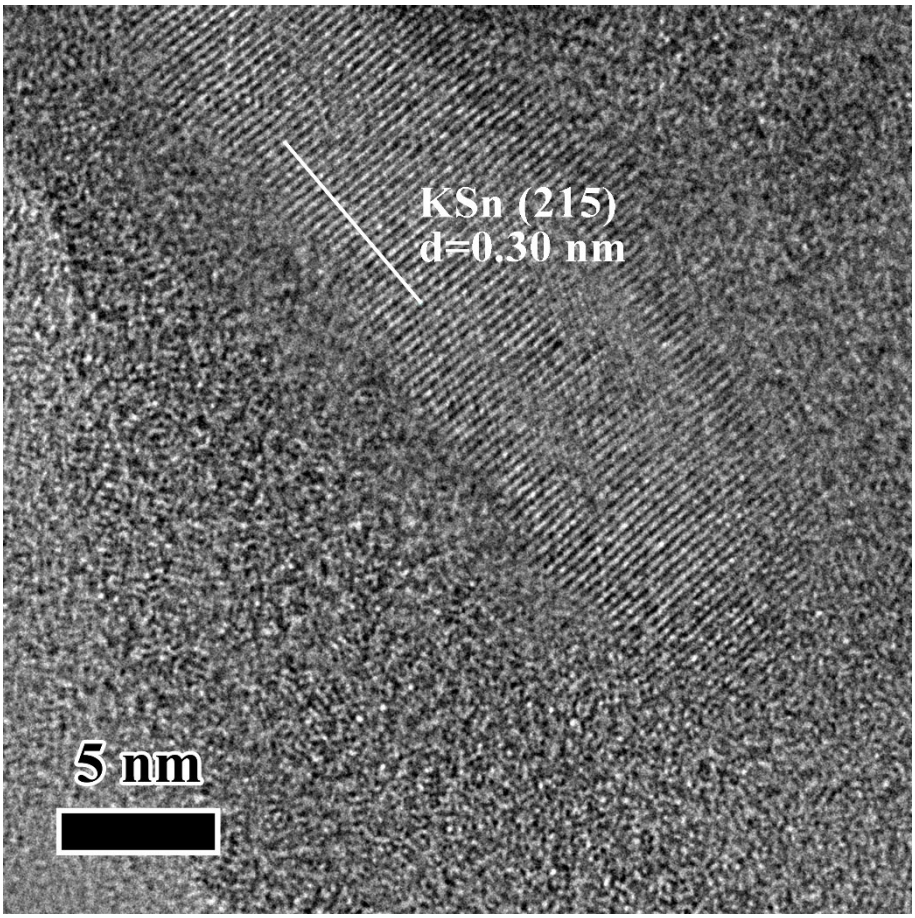

Figure S9 Magnified Figure of **Figure 5b**.

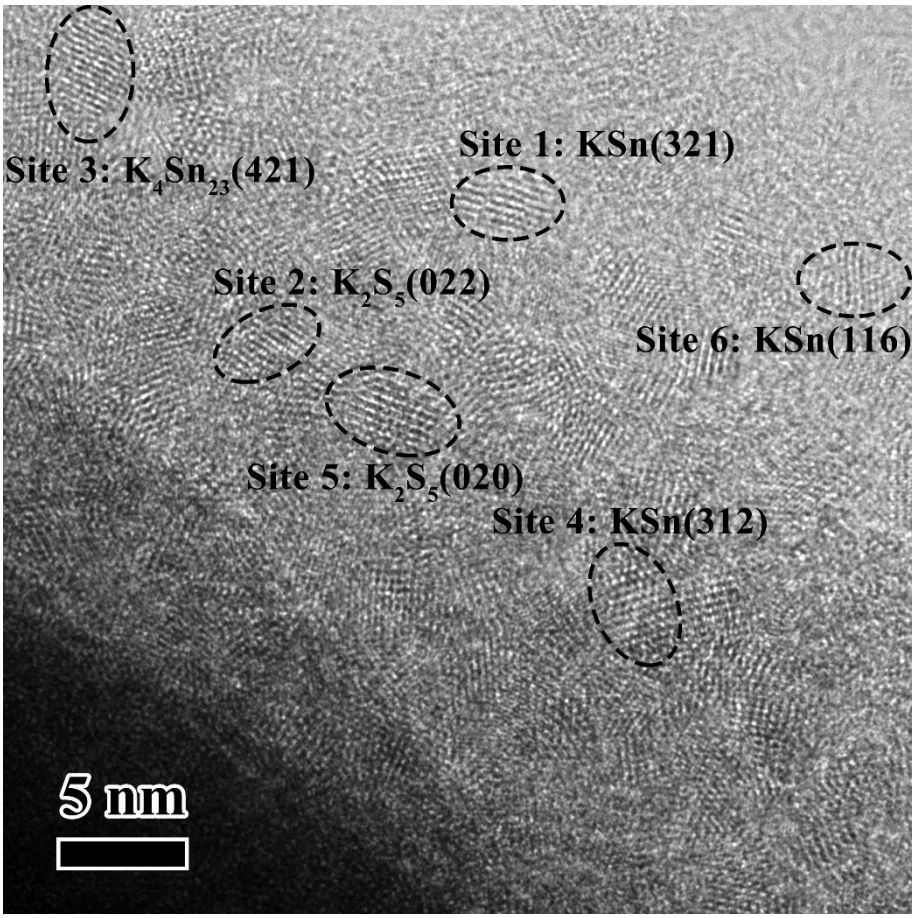

Figure S10 Magnified Figure of **Figure 5c**.

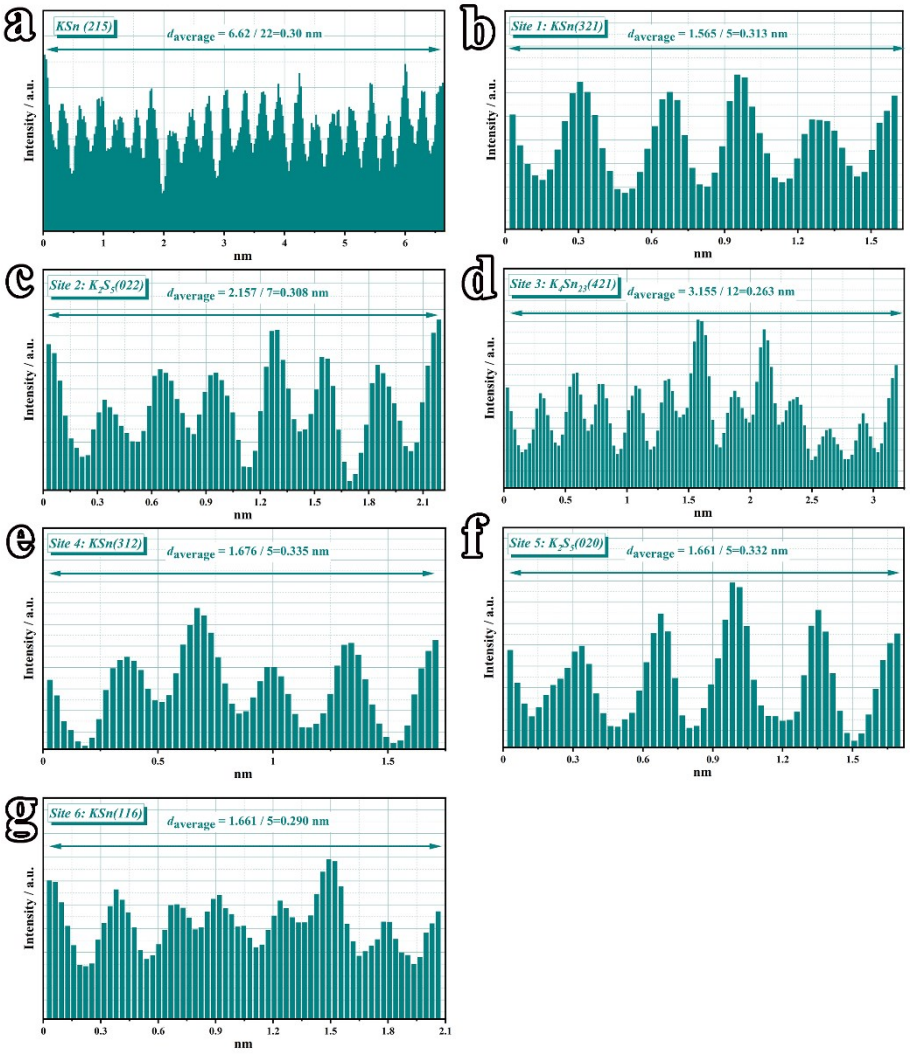

Figure S11 Profiles for averaging the lattice distances in Figure 5b-c and Figrue S9-S10. (a) Plot for Figrue 5b and Figure S9. (b-g) Site 1 to site 6 of Figrue 5c and Figure S10.

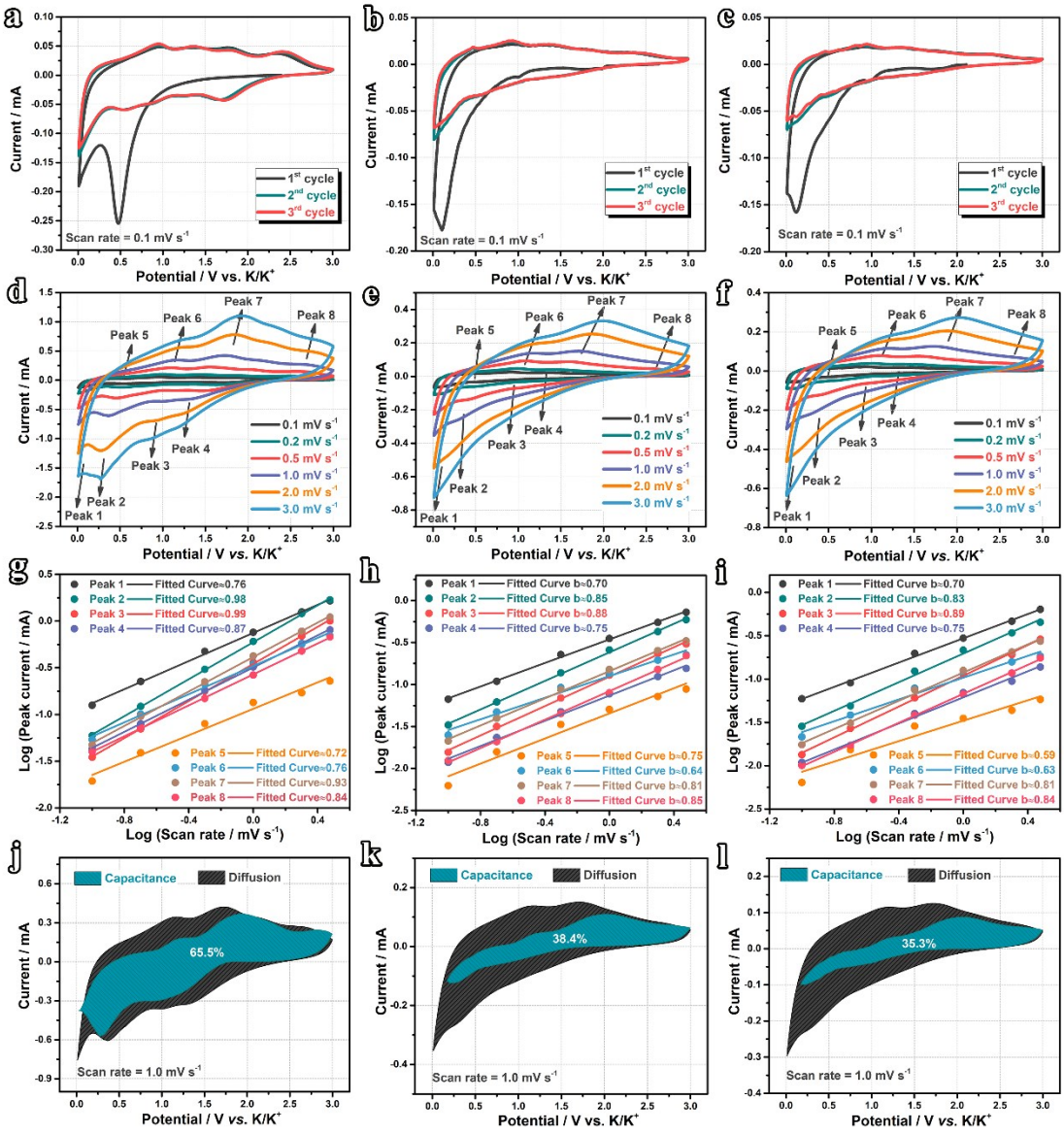

Figure S12. Studies on K-ion storage behaviors. CV curves of (a, d) SnS_2@C-1, (b, e) SnS_2@C-3 and (c, f) SnS_2@C-4 electrodes. Plots for ***b***-value determination and sketch view of the capacitive contribution at 1.0 mV s^{-1}: (g, j) SnS_2@C-1, (h, k) SnS_2@C-3 and (i, l) SnS_2@C-4 electrodes.

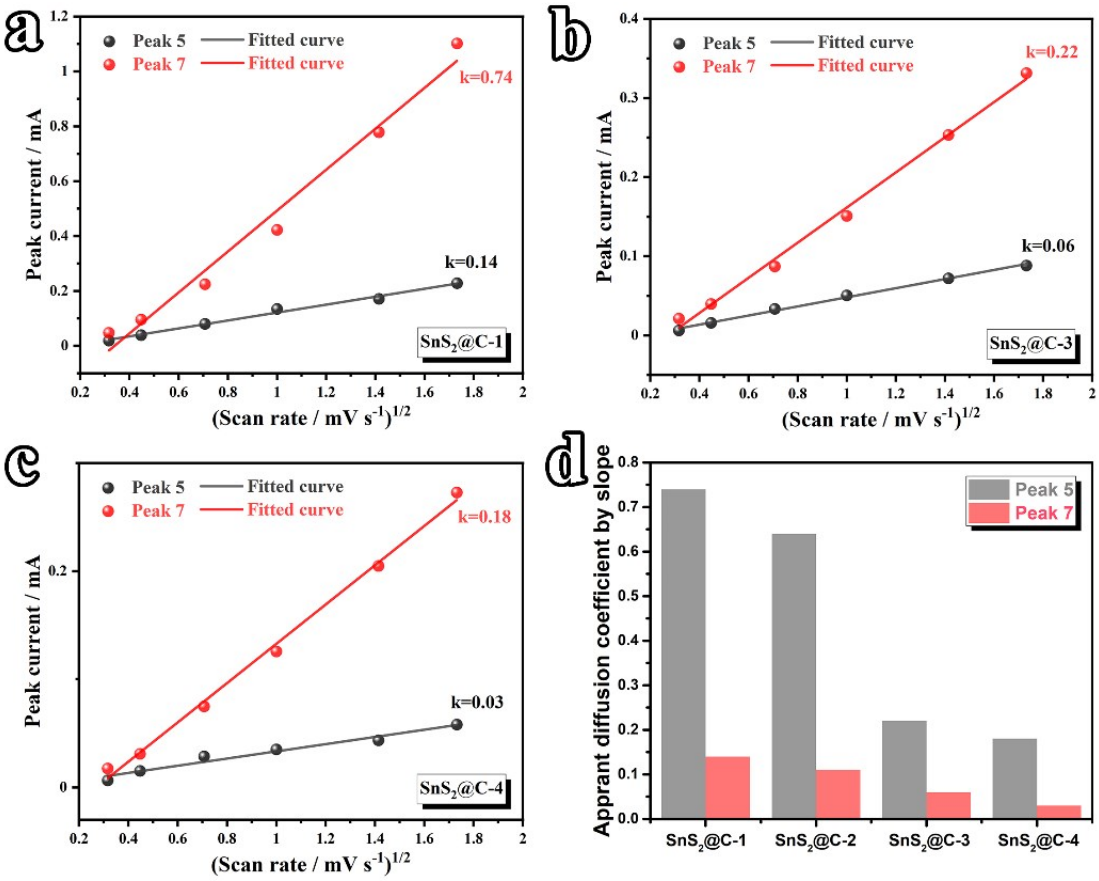

Figure S13. Evaluations of K-ion diffusion kinetics. Plots for K-ion diffusion coefficient determination: (a) SnS_2@C-1, (b) SnS_2@C-3, (c) SnS_2@C-4. (d) Survey of the K-ion diffusion coefficient of SnS_2@C-x electrodes.

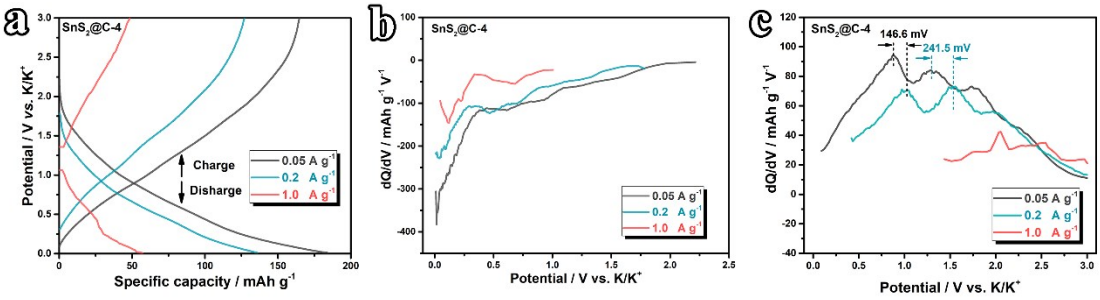

Figure S14. (a) Charge-discharge curves, dQ/dV profiles of (d) potassiation and (e) de-potassiation processes of SnS_2@C-4 electrode at selected current densities.

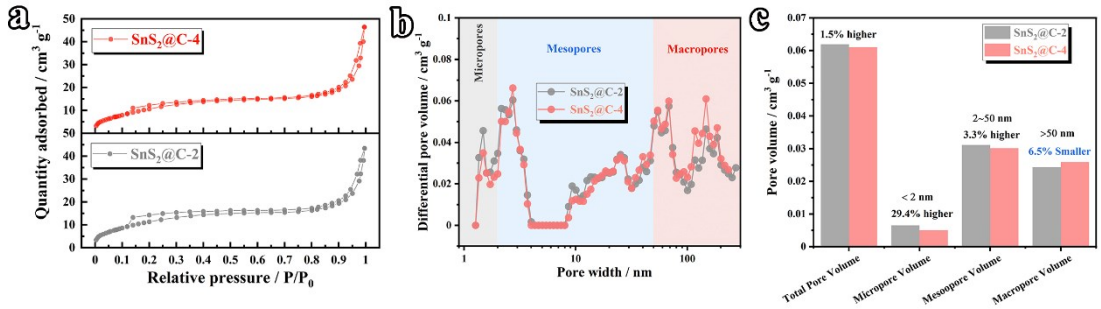

Figure S15. Evaluations on pore structure of SnS_2@C-2 and SnS_2@C-4. (a) N_2 adsorption-desorption isotherms, (b) pore size distributions calculated by NLDFT model (Non-local density functional theory), (c) pore volume distributions.

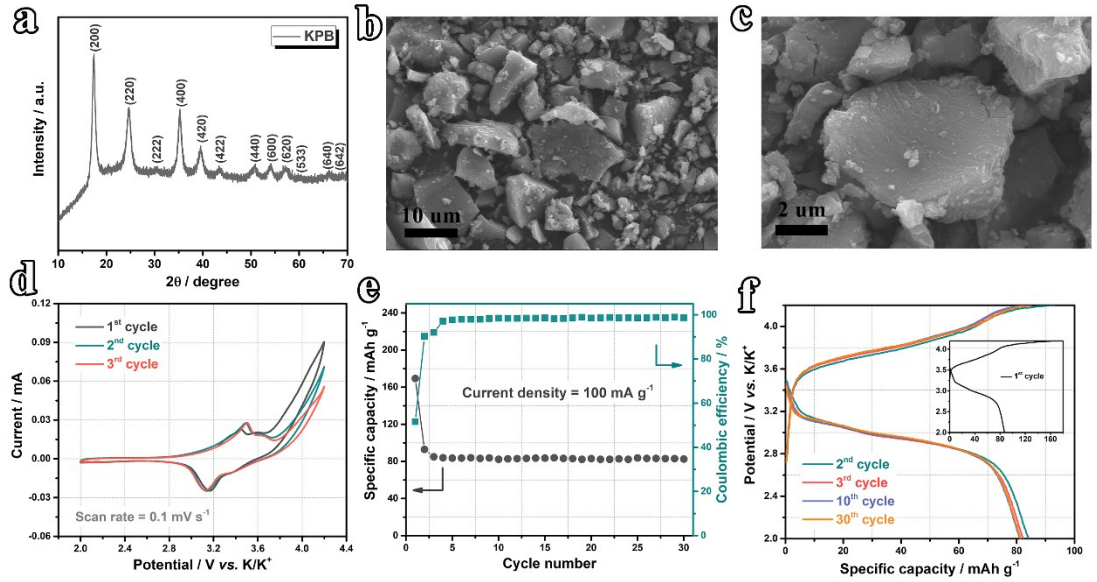

Figure S16. Microstructural and electrochemical evaluations of KPB cathode materials. (a) XRD pattern. (b-c) SEM images. (d) CV curves at 0.1 mV s^{-1}. (e) Cycling performance and (f) corresponding GCD profiles

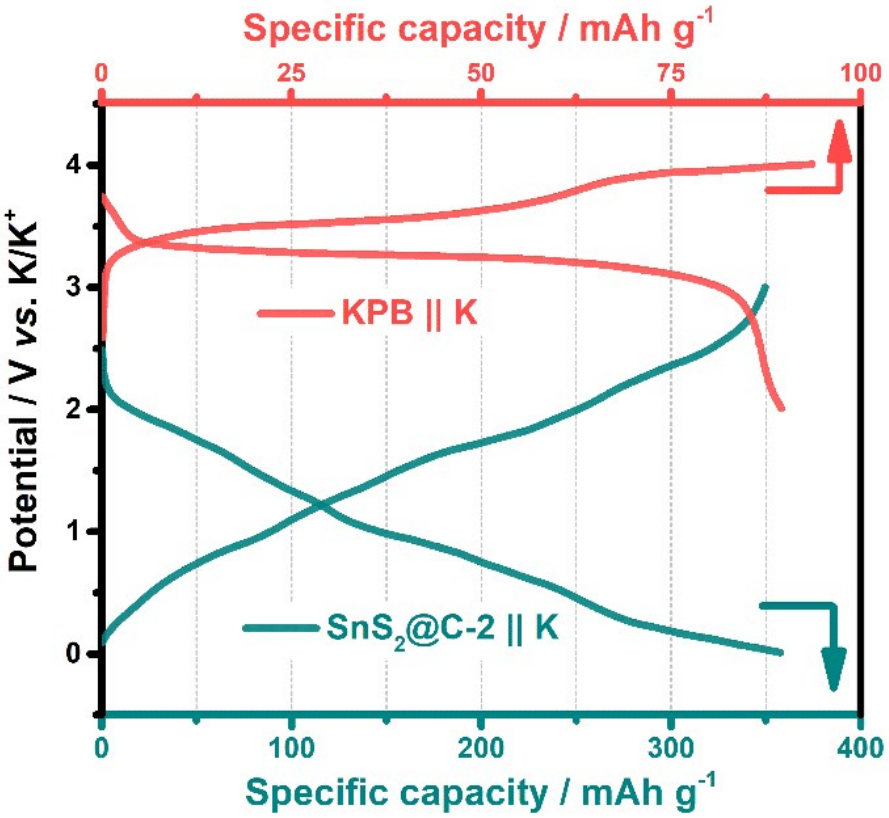

Figure S17. GCD profiles for cathode-anode match before the full-cell assembly.

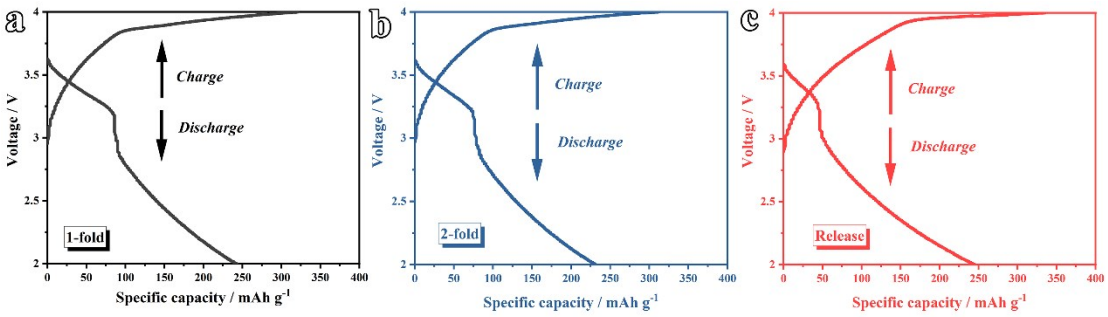

Figure S18. GCD profiles of pouch cell at various deformation states. (a) 1-fold, (b) 2-fold and (c) Final release state.

Table S1. A survey of reported anode materials for PIBs.

Anode Materials	Electrolyte	Reversible capacity & Rate capability	Cycling stability	Refs
SnS_2@NCNF	0.8 M KPF_6 in EC:DEC(1:1)	457.4 mAh/g@50 mA/g 289.7 mAh/g@1000 mA/g 219.4 mAh/g@5000 mA/g	342.2 mAh/g@200 cycles@100 mA/g 183.1 mAh/g@1000 cycles@2000 mA/g	This work
Carbonaceous electrode materials				
Graphite	0.8 M KPF_6 in EC:DEC(1:1)	263 mAh/g@27.9 mA/g 80 mAh/g@279 mA/g	100 mAh/g@50 cycles@140 mA/g	**1**
Soft carbon	0.8 M KPF_6 in EC:DEC(1:1)	273 mAh/g@6.975 mA/g 140 mAh/g@1395 mA/g	150.6 mAh/g@50 cycles@558 mA/g	**1**
N-doped graphene	0.8 M KPF_6 in EC:DEC(1:1)	200 mAh/g@100 mA/g 50 mAh/g@200 mA/g	210 mAh/g@100 cycles@100 mA/g	**2**
Hard carbon	0.8 M KPF_6 in EC:DEC(1:1)	262 mAh/g@28 mA/g 136 mAh/g@1400 mA/g	216 mAh/g@100 cycles@28 mA/g	**3**
Amorphous ordered carbon	0.8 M KPF_6 in EC:DEC(1:1)	286.4 mAh/g@50 mA/g 144.2 mAh/g@1000 mA/g	146.5 mAh/g@1000 cycles@1000 mA/g	**4**
N-doped hard carbon	0.8 M KPF_6 in EC:DMC(1:1)	365 mAh/g@25 mA/g 118 mAh/g@3000 mA/g	230.6 mAh/g@100 cycles@50 mA/g 123 mAh/g@1100 cycles@1050 mA/g	**5**
N-doped carbon nanofiber	0.8 M KPF_6 in EC:PC(1:1)	238 mAh/g@100 mA/g 101 mAh/g@20000 mA/g	248 mAh/g@100 cycles@25 mA/g 146 mAh/g@4000 cycles@2000 mA/g	**6**
Hierarchical CNT	0.8 M KPF_6 in EC:DEC(1:1)	~ 330 mAh/g@50 mA/g 162 mAh/g@1600 mA/g	210 mAh/g@500 cycles@100 mA/g	**7**
Porous carbon nanofiber foam	1.0 M KPF_6 in EC:DMC:EMC (4:3:2)	240 mAh/g@50 mA/g 164 mAh/g@1000 mA/g	168 mAh/g@100 cycles@200 mA/g 158 mAh/g@2000 cycles@1000 mA/g	**8**
Activated hollow carbon nanospheres	0.8 M KPF_6 in EC:DEC(1:1)	365.5 mAh/g@200 mA/g 137 mAh/g@4000 mA/g	192.7 mAh/g@5000 cycles@2000 mA/g 144.3 mAh/g@2000 cycles@4000 mA/g	**9**
N-doped hollow carbon	0.8 M KPF_6 in EC:DEC(1:1)	277.8 mAh/g@50 mA/g 204.8 mAh/g@2000 mA/g	225.4 mAh/g@1000 cycles@200 mA/g 163.1 mAh/g@1600 cycles@1000 mA/g	**10**
Coal-based carbon	0.8 M KPF_6 in EC:DEC(1:1)	260 mAh/g@50 mA/g 88 mAh/g@5000 mA/g	118 mAh/g@1200 cycles@1000 mA/g	**11**
Graphite	KFSI:EMC with molar ratio of 1:2.5	255 mAh/g@20 mA/g	255 mAh/g@2000 cycles@20 mA/g	**12**
Defect-rich graphitic nanocarbons	0.8 M KPF_6 in EC:DEC(1:1)	280 mAh/g@50 mA/g 152 mAh/g@1000 mA/g 56.6 mAh/g@5000 mA/g	189 mAh/g@200 cycles@200 mA/g	**13**
N-doped porous carbon	0.8 M KPF_6 in EC:DEC(1:1)	419.7 mAh/g@50 mA/g 185 mAh/g@10000 mA/g	342.8 mAh/g@500 cycles@100 mA/g 144.4 mAh/g@1000 cycles@5000 mA/g	**14**
N-doped carbon microspheres	0.8 M KPF_6 in EC:DEC(1:1)	250 mAh/g@33.6 mA/g 156 mAh/g@5040 mA/g	205 mAh/g@200 cycles@33.6 mA/g 180 mAh/g@4000 cycles@504 mA/g	**15**

Non-carbonaceous electrode materials (Including: Intercalation-type, conversion-type, alloying-type and organic type)				
a-Ti_3C_2 MNRs	0.8 M KPF_6 in EC:DEC(1:1)	141 mAh/g@20 mA/g 60 mAh/g@300 mA/g	42 mAh/g@500 cycles@200 mA/g	**16**
TiSe2	0.8 M KPF_6 in EC:DEC(1:1)	89.0 mAh/g@50 mA/g 44.5 mAh/g@1000 mA/g	~50 mAh/g@300 cycles@400 mA/g	**17**
$K_2Ti_8O_{17}$	0.8 M KPF_6 in EC:DEC(1:1)	~120 mAh/g@20 mA/g 44.2 mAh/g@500 mA/g	110.7 mAh/g@50 cycles@20 mA/g	**18**
MoS_2@rGO	0.8 M KPF_6 in EC:DEC(1:1)	427 mAh/g@50 mA/g 178 mAh/g@500 mA/g	381 mAh/g@100 cycles@100 mA/g	**19**
Co_3O_4-Fe_2O_3/C	0.75 M KPF_6 in EC:DEC(1:1)	Not mentioned	220 mAh/g@50 cycles@50 mA/g	**20**
CoS@G-25	0.6 M KPF_6 in EC:DEC(1:1)	~420 mAh/g@500 mA/g ~220 mAh/g@4000 mA/g	310.8 mAh/g@100 cycles@500 mA/g	**21**
$FeCl_3$@C	0.8 M KPF_6 in EC:DEC(1:1)	269.5 mAh/g@50 mA/g 133.1 mAh/g@5000 mA/g	224.1 mAh/g@500 cycles@100 mA/g 106.1 mAh/g@1300 cycles@2000 mA/g	**22**
CoP@C	0.8 M KPF_6 in EC:DMC:DEC (1:1:1)	174 mAh/g@50 mA/g 54 mAh/g@2000 mA/g	127 mAh/g@1000 cycles@100 mA/g 114 mAh/g@1000 cycles@500 mA/g	**23**
FeS_2@C	1.0 M KPF_6 in EC:PC(1:1)	360 mAh/g@1000 mA/g 203 mAh/g@10000 mA/g	270 mAh/g@1000 cycles@300 mA/g 162 mAh/g@1000 cycles@1000 mA/g	**24**
V_5S_8@C	1.0 M KFSI in EC:PC(1:1)	474 mAh/g@100 mA/g 153 mAh/g@10000 mA/g	360 mAh/g@500 cycles@500 mA/g 190 mAh/g@1000 cycles@2000 mA/g	**25**
$MoSe_2$/Mxene	1.0 M KFSI in EC:DEC(1:1)	350 mAh/g@100 mA/g 183 mAh/g@10000 mA/g	355 mAh/g@100 cycles@200 mA/g 207 mAh/g@300 cycles@5000 mA/g	**26**
Bi/rGO	1.0 M KFSI in EC:DEC(1:1)	309 mAh/g@100 mA/g 235 mAh/g@500 mA/g	290 mAh/g@50 cycles@50 mA/g	**27**
Sn/C	0.8 M $KClO_4$ in EC:DEC(1:1)	310 mAh/g@50 mA/g 150 mAh/g@500 mA/g	276.4 mAh/g@100 cycles@50 mA/g	**28**
Sb/Carbon shpere network	4.0 M KTFSI in EC:DEC(1:1)	589 mAh/g@50 mA/g 530 mAh/g@200 mA/g	551 mAh/g@100 cycles@100 mA/g 504 mAh/g@220 cycles@200 mA/g	**29**
Sb/Carbon nanosheets	1.0 M KPF_6 in EC:DMC(1:1)	395.5 mAh/g@50 mA/g 101.4 mAh/g@2000 mA/g	288.2 mAh/g@50 cycles@50 mA/g 247 mAh/g@600 cycles@200 mA/g	**30**
Red P@CNFs	0.7 M KPF_6 in EC:DEC(1:1)	745 mAh/g@100 mA/g 342 mAh/g@5000 mA/g	650 mAh/g@100 cycles@100 mA/g 282 mAh/g@800 cycles@5000 mA/g	**31**
Amorphous Ge	0.8 M KPF_6 in EC:DEC(1:1)	350 mAh/g@200 mA/g 125 mAh/g@1200 mA/g	210 mAh/g@100 cycles@80 mA/g 175 mAh/g@200 cycles@240 mA/g	**32**
GeP_5	1.0 M KFSI in EC:DEC(1:1)	721.8 mAh/g@20 mA/g 284.2 mAh/g@1000 mA/g	495.1 mAh/g@50 cycles@50 mA/g 213.7 mAh/g@2000 cycles@500 mA/g	**33**
Sn_4P_3/C	0.8 M KPF_6 in EC:DEC(1:1)	399.4 mAh/g@50 mA/g 221.9 mAh/g@1000 mA/g	307.2 mAh/g@50 cycles@50 mA/g	**34**
Sn_4P_3@Carbon Fiber	1.0 M KFSI in EC:DEC(1:1)	514.7 mAh/g@50 mA/g 169.6 mAh/g@2000 mA/g	403.1 mAh/g@200 cycles@50 mA/g 160.7 mAh/g@1000 cycles@500 mA/g	**35**
PASP@SnS_2@	1 M KFSI in	564 mAh/g @ 50 mA/g	372 mAh/g @ 100 cycles @100 mA/g	**36**

CN	DME	273 mAh/g @ 2000 mA/g	269 mAh/g @ 500 cycles @500 mA/g	
SnS_2@C@rGO	0.8 M KPF_6 in EC:DEC(1:1)	499.4 mAh/g@50 mA/g 287.5 mAh/g@500 mA/g	309.1 mAh/g@100 cycles@100 mA/g 298.1 mAh/g@500 cycles@500 mA/g	**37**
SeS_2@NCNFs	0.7 M KPF_6 in EC:DEC(1:1)	751 mAh/g@50 mA/g 372 mAh/g@2000 mA/g	703 mAh/g@150 cycles@50 mA/g 417 mAh/g@1000 cycles@500 mA/g	**38**
Sb_2S_3/C	1.0 M $KSiF_6$ in EC:PC(1:1)	~500 mAh/g@50 mA/g ~50 mAh/g@1000 mA/g	~500 mAh/g@500 cycles@50 mA/g 404 mAh/g@200 cycles@500 mA/g	**39**
SnSb@NC	0.5 M KPF_6 in DME	357.2 mAh/g@50 mA/g 116.6 mAh/g@2000 mA/g	185.8 mAh/g@200 cycles@500 mA/g	**40**
$(Bi,Sb)_2S_3$ Nanotube	3.0 M KFSI in DME	611 mAh/g@100 mA/g 300 mAh/g@1000 mA/g	353 mAh/g@1000 cycles@500 mA/g	**41**
Amorphous black P@C	0.8 M KPF_6 in EC:DEC(1:1)	367 mAh/g@50 mA/g 90 mAh/g@500 mA/g	71.5 mAh/g@500 cycles@500 mA/g	**42**
Sb_2MoO_6/rGO	3.0 M KFSI in DME	402 mAh/g@100 mA/g 161 mAh/g@1000 mA/g	381 mAh/g@50 cycles@200 mA/g	**43**
K_2PC	1.0 M KFSI in EC:DMC(1:1)	245 mAh/g@11 mA/g 79 mAh/g@440 mA/g	190 mAh/g@100 cycles@44 mA/g	**44**
K_2TP	1.0 M KPF_6 in DME	261 mAh/g@50 mA/g 185 mAh/g@1000 mA/g	229 mAh/g@100 cycles@200 mA/g 194 mAh/g@500 cycles@1000 mA/g	**45**
PyBT	0.8 M KPF_6 in EC:DEC(1:1)	358 mAh/g@30 mA/g 104 mAh/g@500 mA/g	272 mAh/g@500 cycles@500 mA/g	**46**

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