

Highly microporous SbPO₄/BC_x hybrid anodes for sodium-ion batteries

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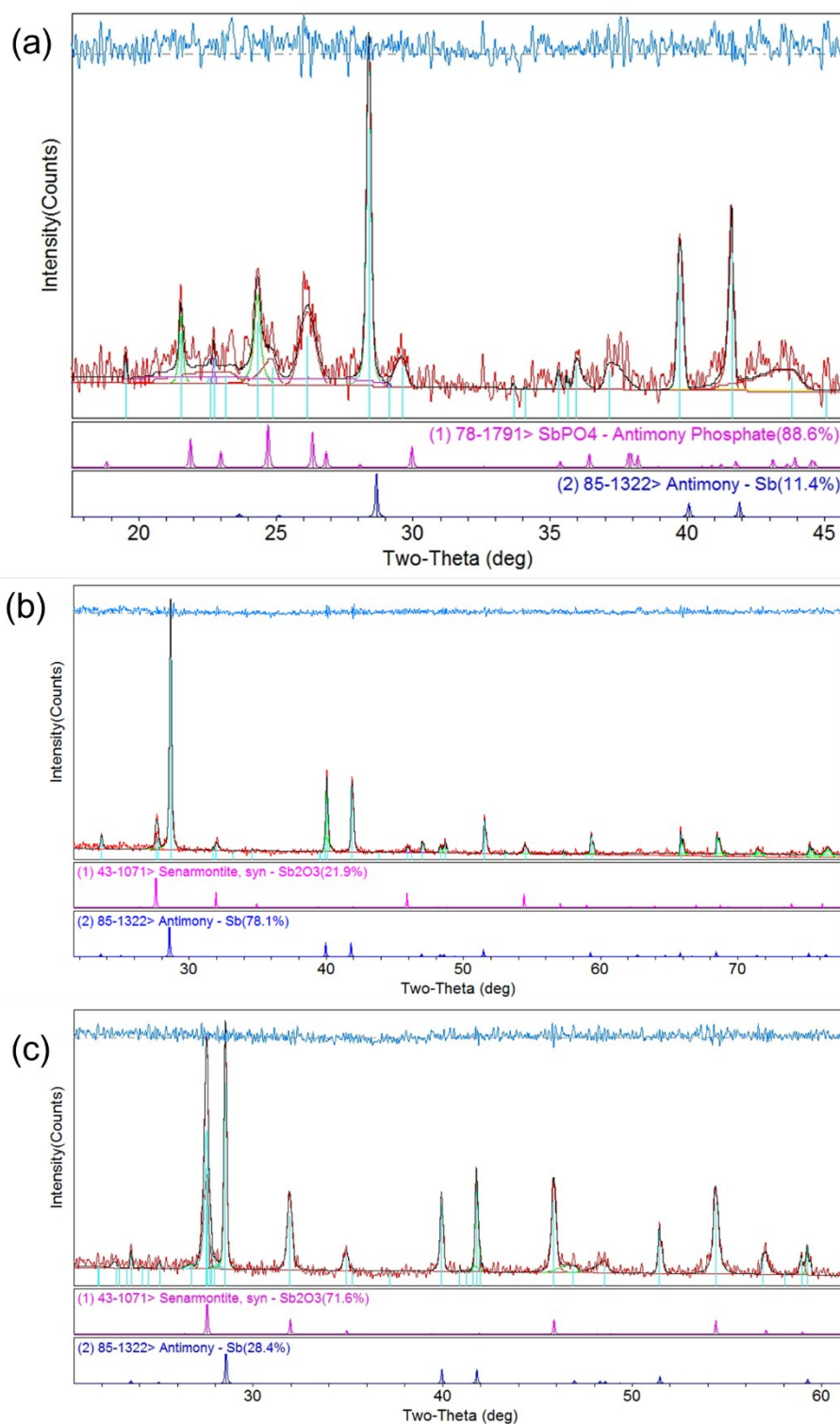


Figure S1 The ratios of Sb species calculated by the quantitative analysis through the Rietveld refinement of XRD pattern in Figure 3d. (a) SbPO₄/BC_x, (b) Sb/BC_x and (c) Sb/C. The red line is the original XRD pattern, the black line is the fitted profile and the short vertical lines mark the line positions of the standards. The spectrum in the top panel is the difference spectrum.

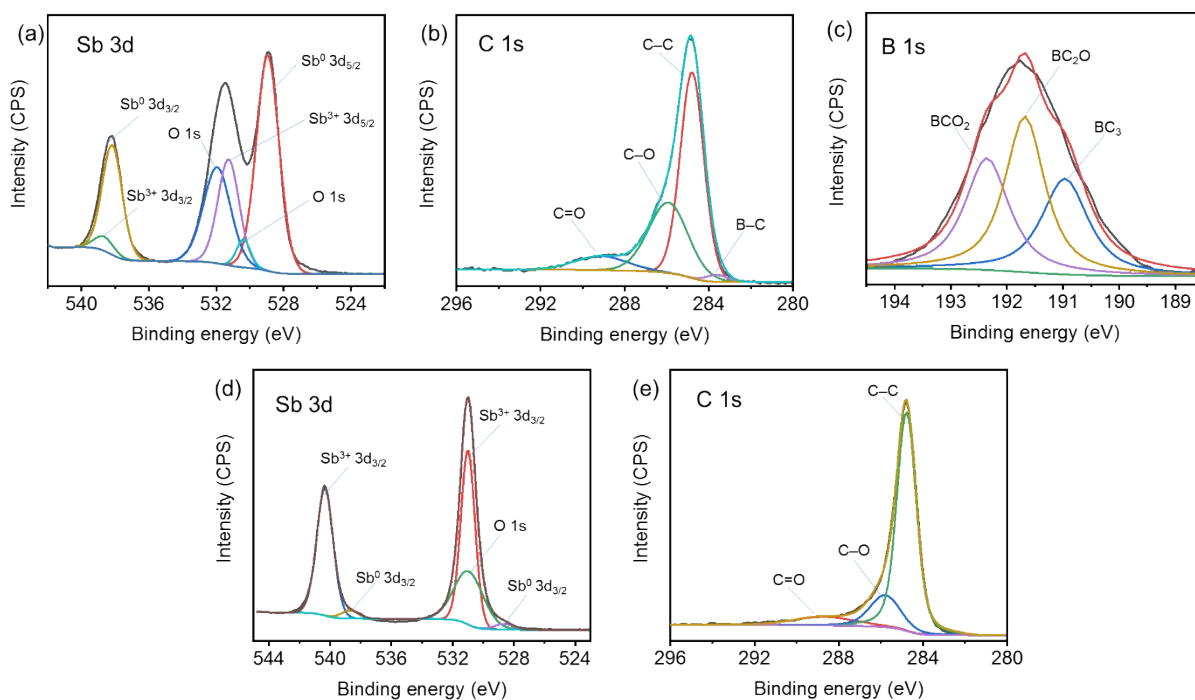


Figure S2 The high-resolution XPS spectra. (a) Sb 3d of the Sb/BC_x sample, (b) C 1s of the Sb/BC_x sample, (c) B 1s of the Sb/BC_x sample, (d) Sb 3d of the Sb/C sample, and (e) C 1s of the Sb/C sample.

Table S1 Physical parameters of as-prepared samples.

Sample	Bonding states	Weight ratio of Sb species ^a	Boron concentration ^b (at. %)	I _D /I _G	S _{BET} (m ² g ⁻¹)
Sb/C	Sb/Sb ₂ O ₃	28.4: 71.6	0	2.21	13.53
Sb/BC _x	Sb/Sb ₂ O ₃	78.1: 21.9	14.40	1.08	183.92
SbPO ₄ /BC _x	Sb/SbPO ₄	11.4: 88.6	12.93	1.11	428.24

^a The value was obtained by Rietveld refinement of XRD pattern.

^b Boron concentration was obtained by XPS.

Table S2 Comparison of sodium storage performance in this work with previously reported in the literature.

Type of materials	Current density (mA g ⁻¹)	Initial capacity (mAh g ⁻¹)	Remained capacity after n cycles (mAh g ⁻¹)	Ref. ^a
Sb	200	521	438/250	1
Sb/Sb ₂ O ₃	660	550	510/180	2
Sb/C	100	670	461/200	3
Sb@C	1000	230	129/2000	4
Sb/C	500	371	349/100	5
Sb@C	1000	280	237/200	6
Sb-C	1000	250	225/200	7
Sb/Acetylene Black	100	504	474/70	8
Sb/MWCNT	200	502	382/120	9
Sb-Graphene	50/300	517 (50)	305/100 (300)	10
SnSb@C/Graphene	100	396	305/100	11
ZnS-Sb ₂ Se ₃ @C	100	630	384/120	12
SbPO ₄ /rGO	500	306	280/100	13
SbPO ₄ /BC _x	200	756	410/150	This work
	500	393	389/10	
	1000	369	367/10	

Table S3 Kinetic parameters calculated by fitting an equivalent circuit of three electrodes.

Sample	Conductivity ^a (× 10 ⁴ S cm ⁻¹)	R _s (Ω)	R _{ct} (Ω)	σ
Sb	0.04	23.09	476.23	149.63
Sb/C	0.05	16.21	327.51	132.90
Sb/BC _x	0.13	9.35	74.01	37.88
SbPO ₄ /BC _x	0.15	27.55	44.43	9.18

^a The data were calculated by using 4-point probe method.

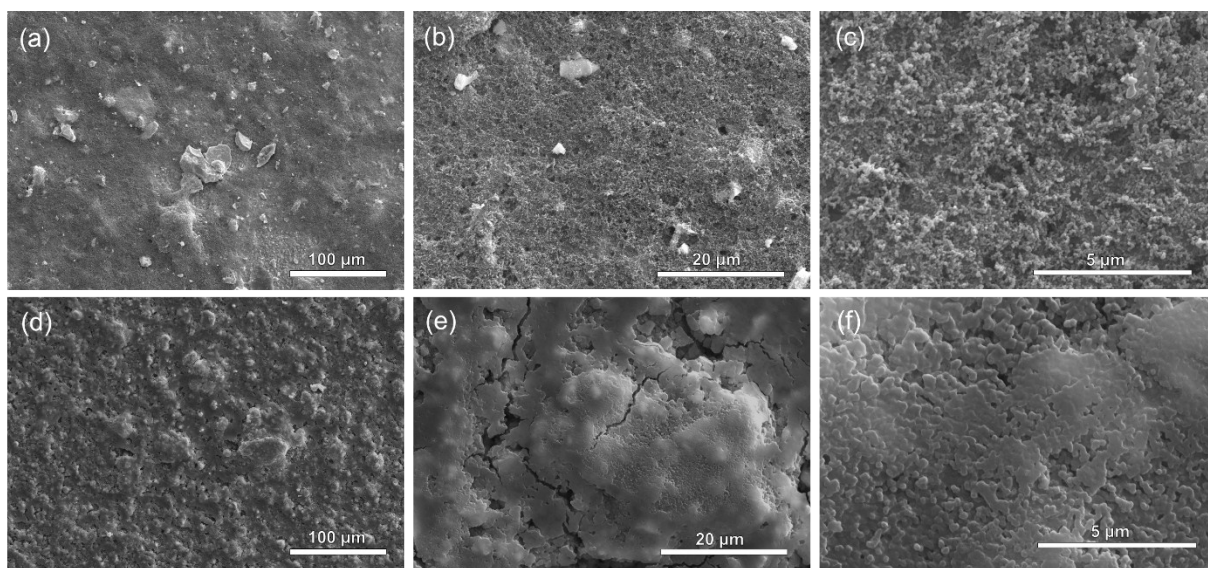


Figure S3 SEM images of $\text{SbPO}_4/\text{BC}_x$ electrode before cycling (a, b, c) and after 500 cycles (d, e, f), respectively.

References

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