Electronic Supplementary Material (ESI) for ChemComm.

Supporting Information

Few-layer Tin-Antimony Nanosheets: A Novel 2D Alloy for Superior Lithium Storage

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Experimental section

The exfoliation of few-layer SnSb nanosheets: firstly, SnSb powders were suspended in three representative solvents such as Isopropyl alcohol (IPA), N-methyl pyrrolidone (NMP), and dimethyl formamide (DMF) with potassium a constant concentration (2 mg mL^{-1}), and then sonicated under ambient condition for the gradual exfoliation of bulk SnSb to nanosheets with increasing sonication time. After that, the products were washed with deionized water and ethanol for several times. Then the samples were collected after centrifugation at 5000 rmp.

Morphological and Structural Characterization: The morphology and microstructure of the samples were systematically investigated by SEM (JEOL-7500), TEM (Tecnai G2 F20 U-YWIN), and XRD (Rigaku D/max2500PC) was carried out using Gu Kα radiation over the rage of 5~90° measurement. Raman spectra of as-prepared samples were recorded on a Horiba JY LaRAM ARAMIS Raman microscopy.

Eletrochemical Measurements: Electrochemical experiments were carried out in 2032 coin-type cells. The working electrodes were prepared by mixing active materials, carbon black, and PVDF at a weight ratio of 7:2:1 and pasted on pure copper foil. and then dried at 120℃ under vacuum for 12 h. Pure lithium foil was used as the counter electrode. The electrolyte consisted of a solution of 1 M $LiPF_6$ in EC:DC = 1:1 (V%) and a glass fiber film as the separator. The cells were assembled in an argon-filled glove box with the concentration of moisture and oxygen below 0.1 ppm. The charge and discharge measurements were operated on Land CT2001A system at various rates (100, 200, 400, 800, 1600, and 6400 mA g^{-1}). Electrochemical impedance spectroscopy (EIS) measurements were executed on Autolab equipment (PGSTAT302N). The electrochemical performance was tested at various current densities in the voltage range of 0.01-3.00 V. The impedance spectra were recorded by applying a sine wave with amplitude of 5.0 mV over the frequency range from 100 kHz to 0.01 Hz. Fitting of the impedance spectra to the proposed equivalent circuit was performed by the code Zview.

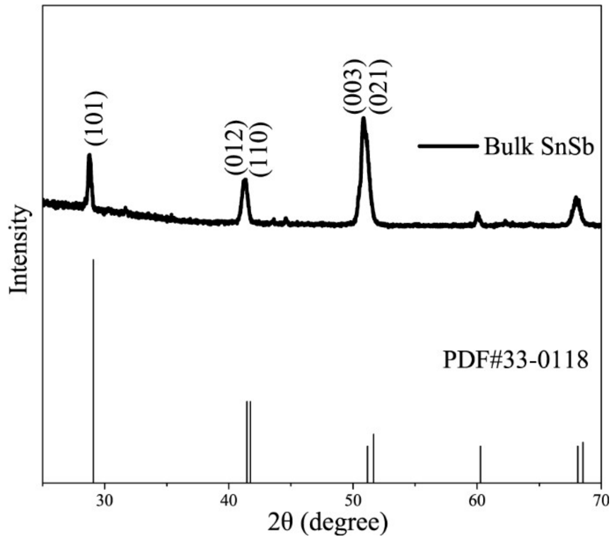

Figure S1. XRD spectra of as-prepared SnSb bulk powders.

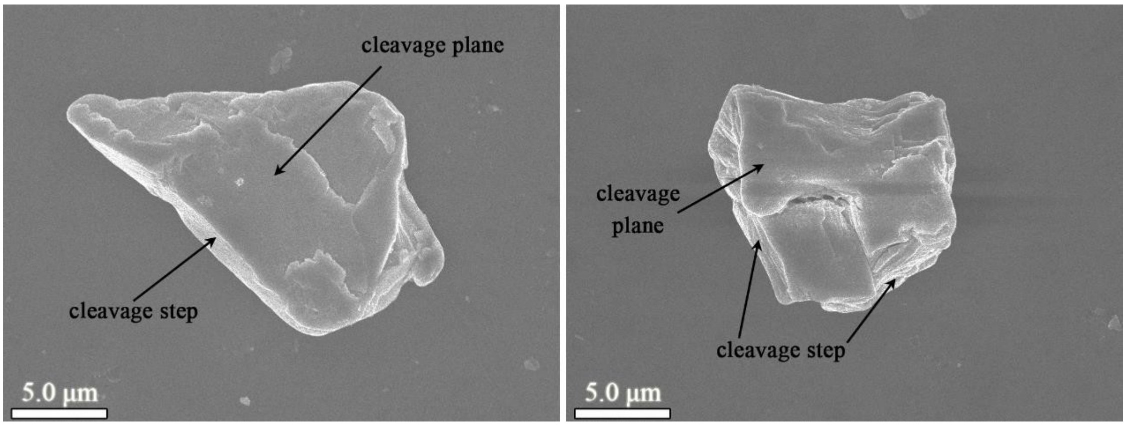

Figure S2. Typical SEM images of SnSb bulk, in which the cleavage steps and planes can be seen.

Figure S3. The exfoliation process of SnSb in three different solvent.

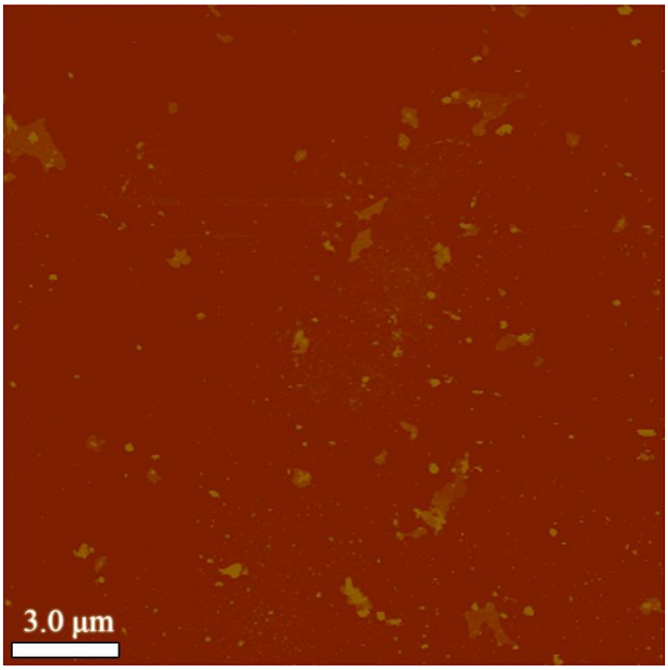

Figure S4. Typical AFM image of few-layer SnSb nanosheets in large area.

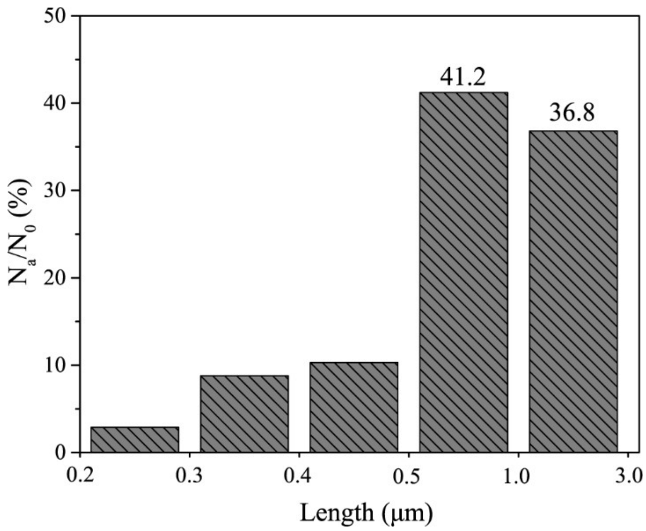

Figure S5. The statistical diagram about the length of the whole SnSb atomic layers based on more than 60 nanosheets, reflecting the length of SnSb atomic layers are mainly distributed from 0.5 to 1.0 μm.

Figure S6. The Tyndall Effect of few-layer SnSb nanosheets dispersed in alcohol.

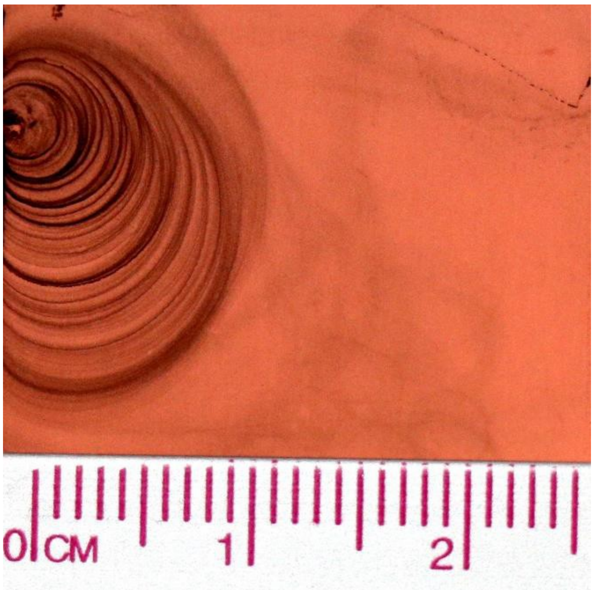

Figure S7. The coffee ring when drop the suspension onto a copper foil.

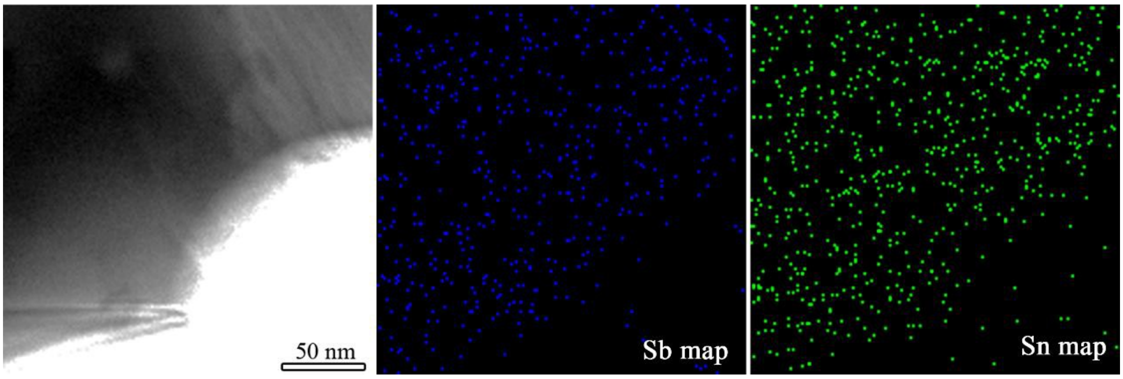

Figure S8. Typical STEM image as well as corresponding Sb map and Sn map, which reflect the uniformly distribution of Sn and Sb elements into few-layer SnSb nanosheets.

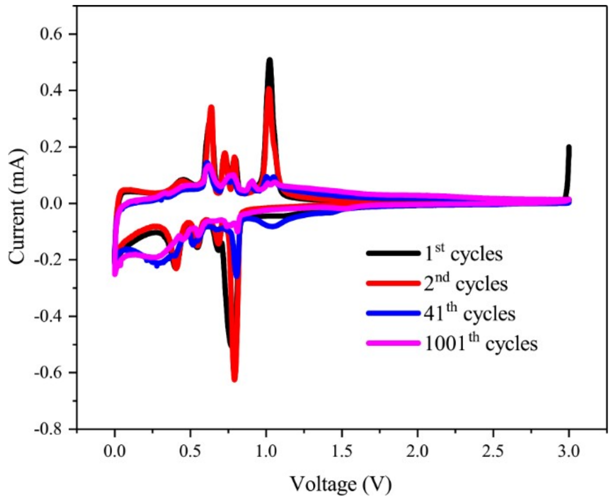

Figure S9. CV profiles of few-layer SnSb at a scan rate of 0.1 mV s^{-1} at different cycle times.

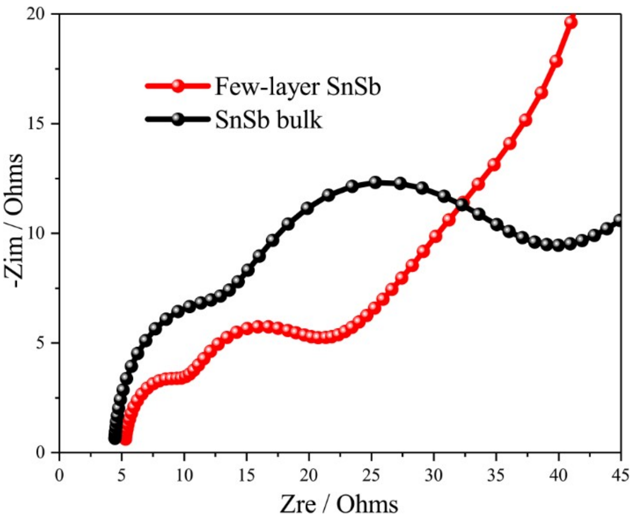

Figure S10. Nyqiust plots of few-layer SnSb and SnSb bulk tested after 2 cycles.

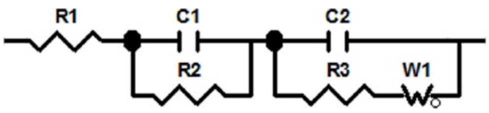

Figure S11. Randles equivalent circuit for few-layer SnSb naonsheets and SnSb bulk electrode/electrolyte interface. R_1 is the electrolyte resistance, and C_1 and R_2 are the capacitance and resistance of the surface film formed on the electrodes, respectively. C_2 and R_3 are the double-layer capacitance and charge-transfer resistance, respectively, W_1 is the Warburg impedance related to the diffusion of lithium ions into the electrodes.

Table S1. Comparison of electrochemical properties between few-layer SnSb and the reported SnSb-based materials.

Smaples	Current desntiy ($mA\ g^{-1}$)	Cycles	Specific capacity ($mAh\ g^{-1}$)	Ref.
Few-layer SnSb	100	40	450	Our work
Few-layer SnSb	6400	1000	200	Our work
SnSb alloy nanoparticles	2000	1000	55	[1]
SnSb alloy nanoparticles	225	40	600	[2]
SnSb/MCMB/carbon	100	100	455	[3]
SnSb @carbon nanofibers	50	150	600	[4]
SnSb/graphene	500	75	486	[5]
SnSb(microwave)	456	500	300	[6]

Table S2. Kinetic parameters of few-layer SnSb and SnSb bulk.

	R1	R2	R3
Few-layer SnSb	10.2	5.1	8.6
SnSb bulk	4.4	9.2	18.7

Ref.

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