Supplementary Information

Electrochemical performance of rod-like Sb-C composite as anodes for Li-ion and Na-ion batteries

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Experimental

Preparation of Sb_2O_3 microrods precursor.

In a typical synthesis, 2 mmol $SbCl_3$ was dissolved into 30 mL of ethanol under magnetic stirring. Then, 18 ml 1M NaOH solution was dropwise added to the above mixture. After continually stirred for 1 h, the solution was transferred into a Teflon-lined autoclave and kept at 150 ºC for 24 h. After cooled to ambient temperature, the resulting products were collected by centrifugation, washed with distilled water and absolute ethanol, and dried under vacuum at 50 ºC for 12 h.

Preparation of rod-like Sb-C composite.

Rod-like Sb-C composite was prepared by thermal annealing C_2H_2 with the corresponding Sb_2O_3 _

precursor. The dried Sb_2O_3 precursor was annealed in a electric furnace at 480 ºC under continuous C_2H_2/argon gas flow (1/9; v/v) for 16 h with the heating rate of 3 ºC min^{-1}. After cooled to ambient temperature, the product was then collected for further characterization.

Material characterization.

The X-ray powder diffraction (XRD) patterns of the products were characterized by a Philips X' pert X-ray diffractometer with Cu Ka radiation (λ=1.541874Å). Raman spectra were collected on a JYLABRAM-HR Confocal Laser Micro-Raman spectrometer at room temperature. The carbon content was measured on a vario EL-III elemental analyzer. The structure and morphology of the samples were observed by a field emission scanning electron microscope (SEM, JEOL-JSM-6700F) and transmission electron microscope (TEM, H7650).

Electrochemical measurements.

The working electrode was composed of the active material, carbon black and polyvinylidene difluoride (PVDF) in a weight ratio of 70:20:10. The electrode was prepared by casting the slurry onto copper foil and drying in a vacuum oven at 100 ºC for 12 h. The mass of the active material was around 2 mg cm^{-1}. Li-ion batteries were assembled with lithium as the counter electrode, 1.0 M $LiPF_6$ in a mixture of ethylene carbonate/diethyl carbonate (EC/DMC = 1/1, V/V) as the electrolyte and a porous polypropylene membrane (Celgard 2400) as the separator. Na-ion batteries were also fabricated at the same conditions using sodium as the counter electrode, 1.0 M $NaClO_4$ in a mixture of ethylene carbonate/diethyl carbonate (EC/DMC = 1/1, V/V) as electrolyte solution, and a glass fiber (GF/D) from Whatman as the separator. Electrochemical performance was tested using a Land-CT2001A battery test station in the voltage range of 0.01 - 2.5 V. Capacity was calculated on the basis of the total mass of the Sb-C composite. Cyclic voltammogramsats (CV) with a scan rate of 0.1 mV s^{-1} between 0.01 and 2.0 V were recorded using a CHI650A electrochemical workstation.

Fig. S1. XRD patterns of Sb_2O_3 microrods precursor.

Fig. S2. SEM images of Sb_2O_3 microrods precursor and rod-like Sb-C composite.

Fig. S3 N_2 adsorption-desorption isotherms and pore size distributions of Sb_2O_3 precursor

Table. S1 Comparison of rod-like Sb-C composite (this work) and various reported Sb-C as anodes for Li-ion or Na-ion batteries.

Material	Reversible capacity/mAh g^{-1}	Rate (mA g^{-1})	Batteries	Ref.
Rod-like Sb-C composite	478.8/100th cycles	100	Li-ion	This work
Hollow Sb Nanoparticles	615/100th cycles	120	Li-ion	[22]
Sb nanoparticles	120/70th cycles	120	Li-ion	[23]
Sb nanowires	200/70th cycles	120	Li-ion	[23]
Sb-carbon nanocomposite	550/250th cycles	230	Li-ion	[24]
Rod-like Sb-C composite	430.9/100th cycles	50	Na-ion	This work
Sb/C nanocomposite	400/60th cycles	100	Na-ion	[25]
Sb/C Fibers	350/300th cycles	100	Na-ion	[26]
Sb–C nanofibers	446/400th cycles	200	Na-ion	[27]
Sb-carbon microspheres	372/300th cycles	300	Na-ion	[28]