Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Electronic Supplementary Information

Synthesis of Co_2SnO_4 hollow cubes encapsulated in graphene as high capacity anode materials for Lithium-Ion Batteries

Jingjing Zhang [a], Jianwen Liang [a], Yongchun Zhu [a, *], Denghu Wei [a], Long Fan [a] and Yitai Qian [a, b, *]

[a] *Hefei National Laboratory for Physical Science at Microscale and Department of Chemistry, University of Science and Technology of China, Hefei, 230026, P.R. China. Tel: +86-551-63601589; E-mail: ychzhu@ustc.edu.cn*
[b] *School of Chemistry and Chemical Engineering, Shandong University, Jinan, 250100, PR China. Tel: +86-551-63607234; E-mail: ytqian@ustc.edu.cn*

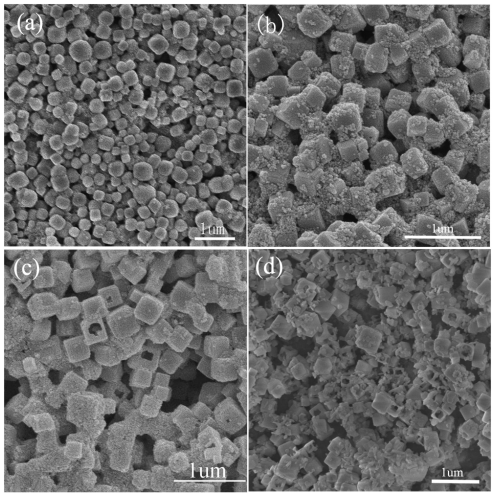


Fig. S1. SEM images of a series of temperature-dependent experiments of precursor (a) prepared at room temperature, (b) at 100 °C, (c) at 120 °C and (d) 140 °C.

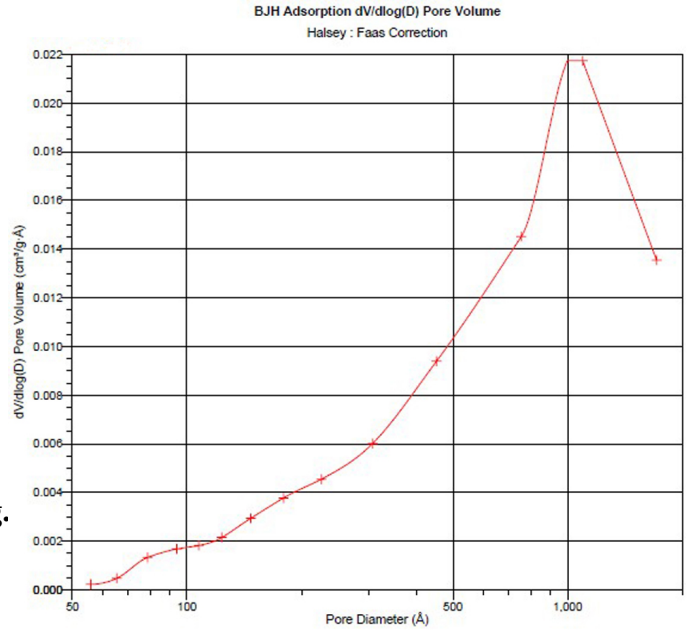


Fig. nO_4 HCs.

Fig. S3. BJH porous distribution of Co_2SnO_4 HCs (V = differential pore volume, D = pore size)

Fig. S4. SEM images of (a,b) the precursor and its TEM pattern (inset b) and (c,d)

Element	Atomic %
Co K	66.26
Sn L	33.74
Total	100

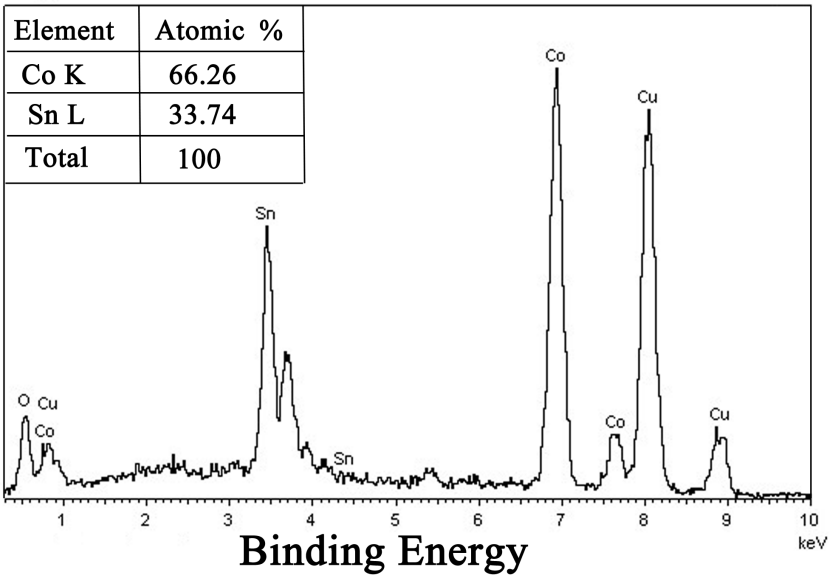
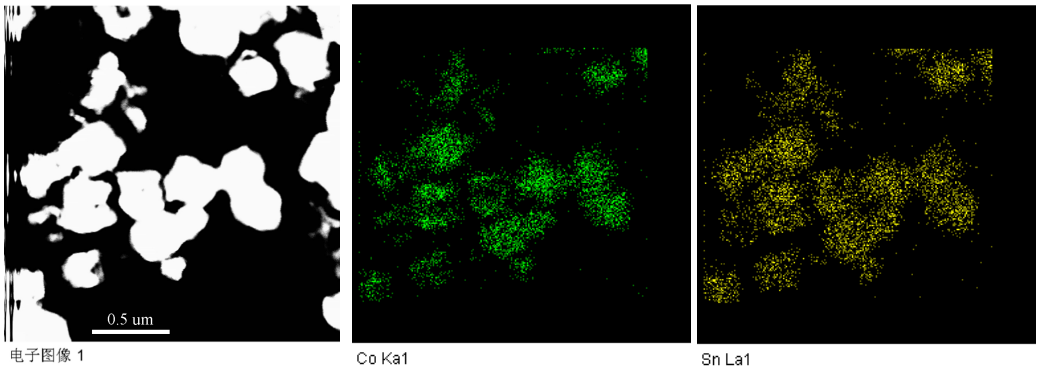
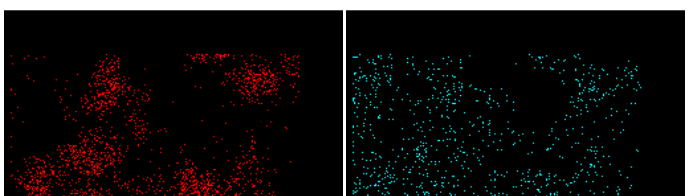


Fig. S5. Typical EDX spectrums of Co_2SnO_4 HCs.





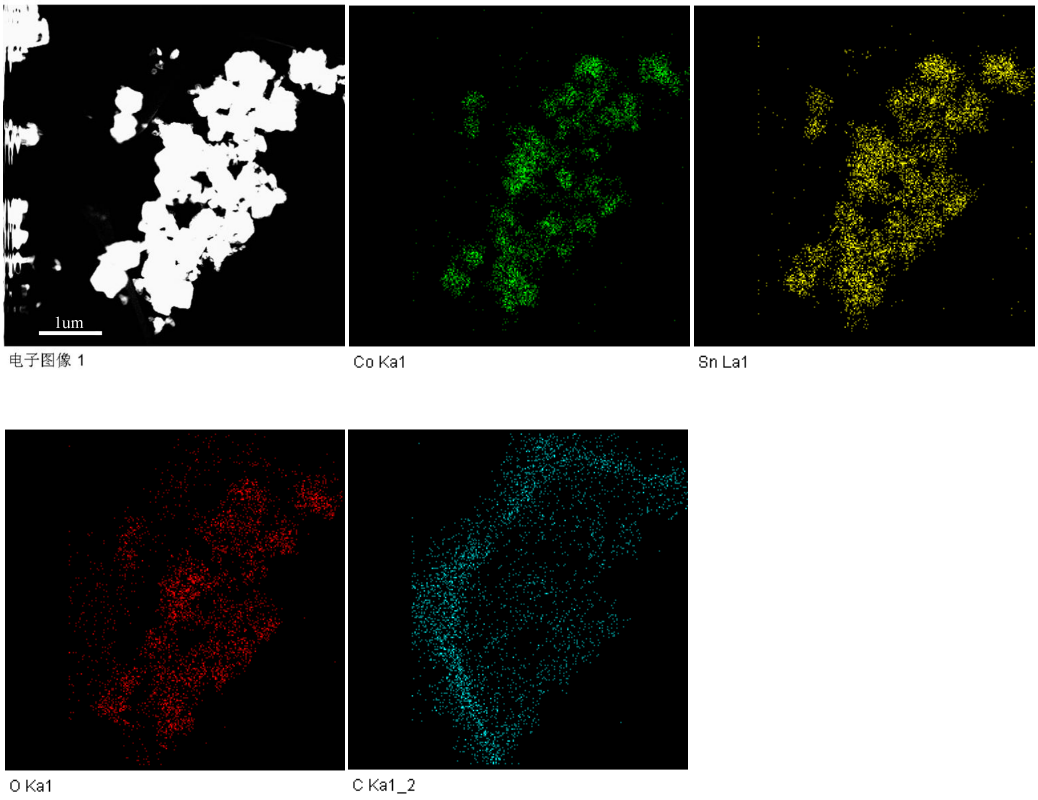


Fig. S6. TEM image and corresponding oxygen, cobalt, tin, and carbon elemental mapping of Co_2SnO_4 HCs@GO.

Fig. S7. Typical XRD patterns of Co_2SnO_4 HCs@rGO.

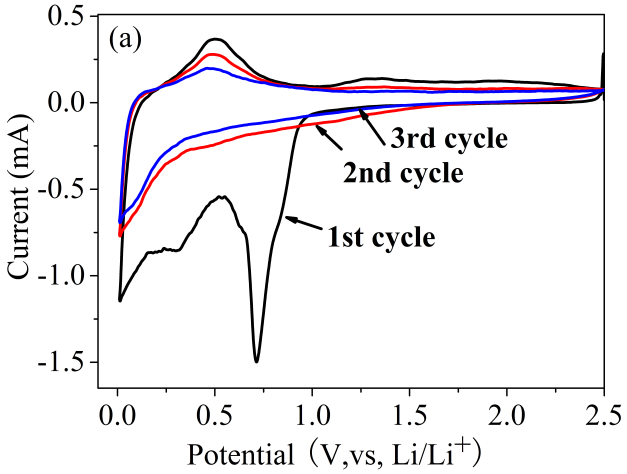


Fig. S8. Cyclic voltammograms of Co_2SnO_4 NCs at a scanning rate of 0.1 mVs^{-1}.

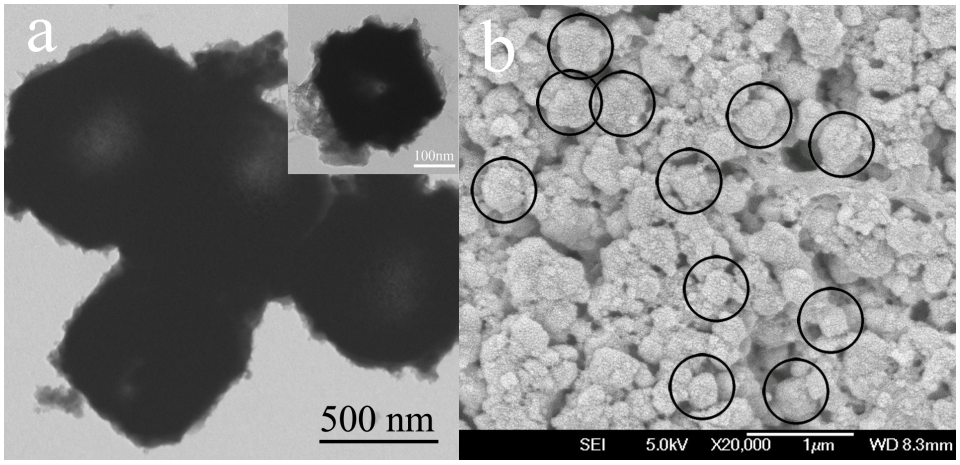


Figure S9. (a) TEM (high-magnification TEM image inset) and (b) FESEM images of Co_2SnO_4 HCs@GO after cycling for 100cycles. In the FESEM image, the hollow cubes are marked with black circle.

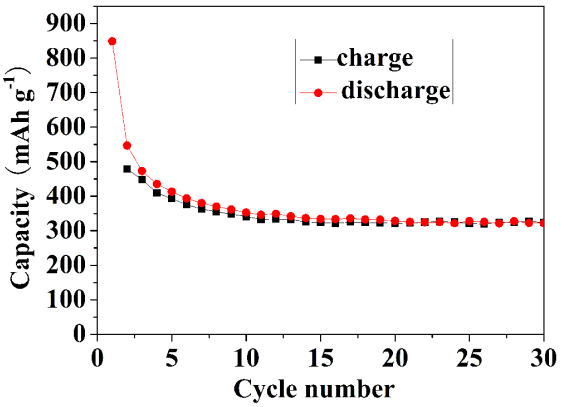


Fig. S10. Charge/discharge profiles of the graphite.

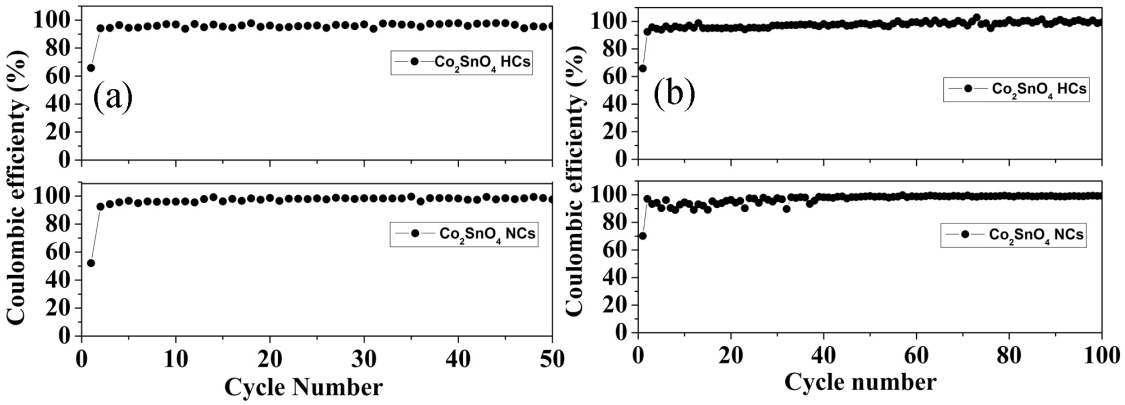


Fig. S11. Coulombic efficiency of (a) cycle performance at a current density of 100 mA g^{-1} between 0.01 and 2.5 V and (b) Rate capability at various current densities between 0.01 and 2.5 V for Co_2SnO_4 NCs and Co_2SnO_4 HCs.

For Co_2SnO_4 NCs and Co_2SnO_4 HCs, the coulombic efficiency maintains

consistently at ~97% up to 100 cycles (shown in Fig. S11a) and also keeps at ~97% following the rising rates (in Fig. S11b).

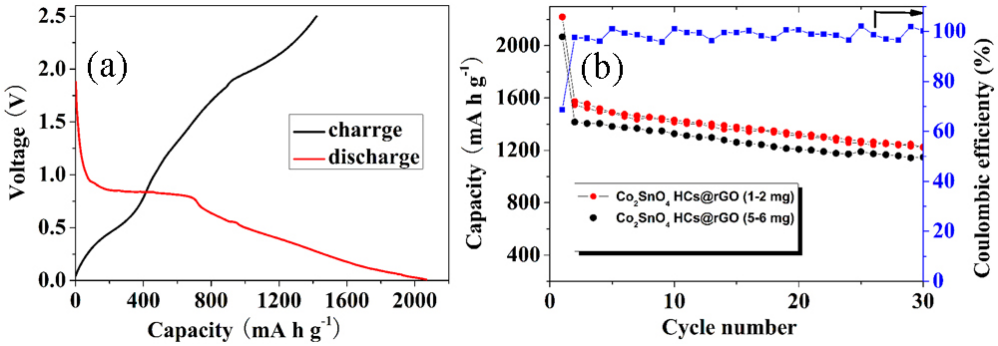


Fig. S12. (a) The initial discharge-charge curves for Co_2SnO_4 HCs@rGO (5-6 mg) at a current density of 100 mA g^{-1} between 0.01 and 2.5 V, (b) cycle performance at a current density of 100 mA g^{-1} between 0.01 and 2.5 V, and the coulombic efficiency of the Co_2SnO_4 HCs@rGO (5-6 mg).

Table 1 comparison between Co_2SnO_4 hollow cubes/graphene composite (Co_2SnO_4 HCs@rGO) (this work) and the reported Co_2SnO_4 compounds.

Material	Reversible capacity (mAh g^{-1})	Percentage of theoretical capacity	current density (mAg^{-1})	Ref.
Co_2SnO_4 HCs@rGO	1016.2/100cycles	91.9%	100	this work
Co_2SnO_4 HCs	410/100cycles	37.1%	100	this work
Co_2SnO_4 NCs	179/100cycles	16.2%	100	this work

solid Co_2SnO_4	490/2cycles	44.3%	50	6
bulk Co_2SnO_4	112.8/50cycles	11%	30	8
Co_2SnO_4 nanocrystals	555.9/50cycles	50.3%	30	8
Co_2SnO_4 @C core-shell nanostructures	474/75cycles	42.8%	100	18
Co_2SnO_4 nanoparticles@ multiwalled carbon nanotubes	898.8/50cycles	81.3%	50	19