Electronic Supplementary Material (ESI) for Journal of Materials Chemistry

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Three-Dimensional Nanoarchitecture of Sn-Sb-Co Alloy as Anode of Lithium-ion Battery with excellent lithium storage performance**

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RESULT AND DISCUSSION

1. Electrochemical reduction of CuO NRA

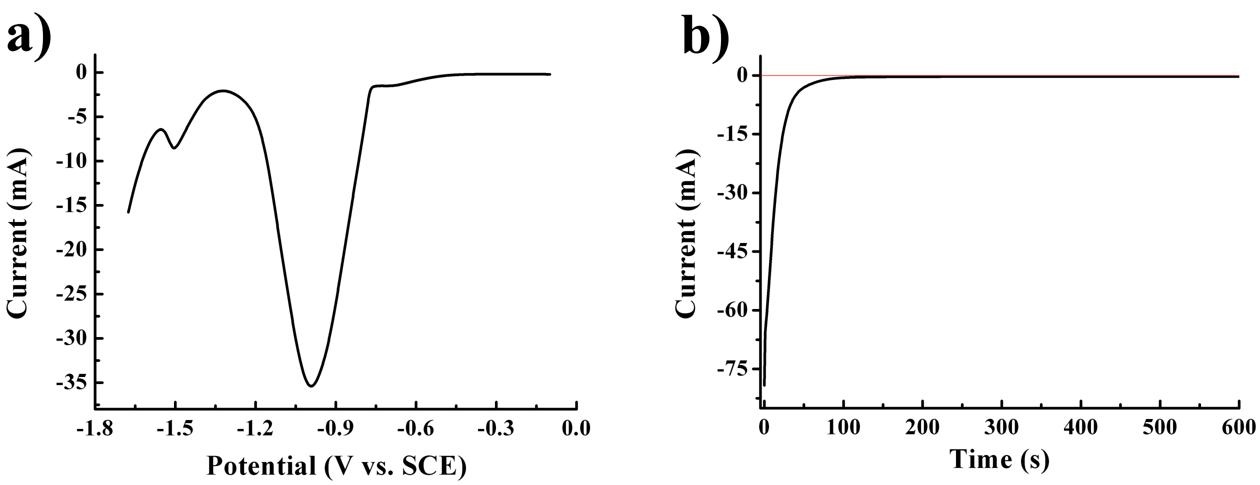

Figure S1. (a) Linear sweep voltammetry of CuO NRA on copper sheet at a scan rate of 0.01 V s^{-1}. 1.0 M Na_2SO_4 was used as the supporting electrolyte. (b) Current-time curves recorded by chronoamperometry for the CuO NRA in 1.0 M Na_2SO_4 at room temperature. The geometric area of the working electrode was 1.0 cm^2.

During the chronoamperometry experiment, the pH was determined by a test strip. Results show that the pH near the working electrode and counter electrode are 10 and 4, respectively. Air bubbles were observed on the counter electrode. The electroreduction of CuO NRA into Cu NRA is described by the following reactions:

Cathodic: $CuO + H_2O + 2e^- \rightarrow Cu + 2OH^-$

Anodic: $H_2O - 2e^- \rightarrow 1/2O_2 + 2H^+$

2. XRD patterns of CuO NRA and Cu NRA

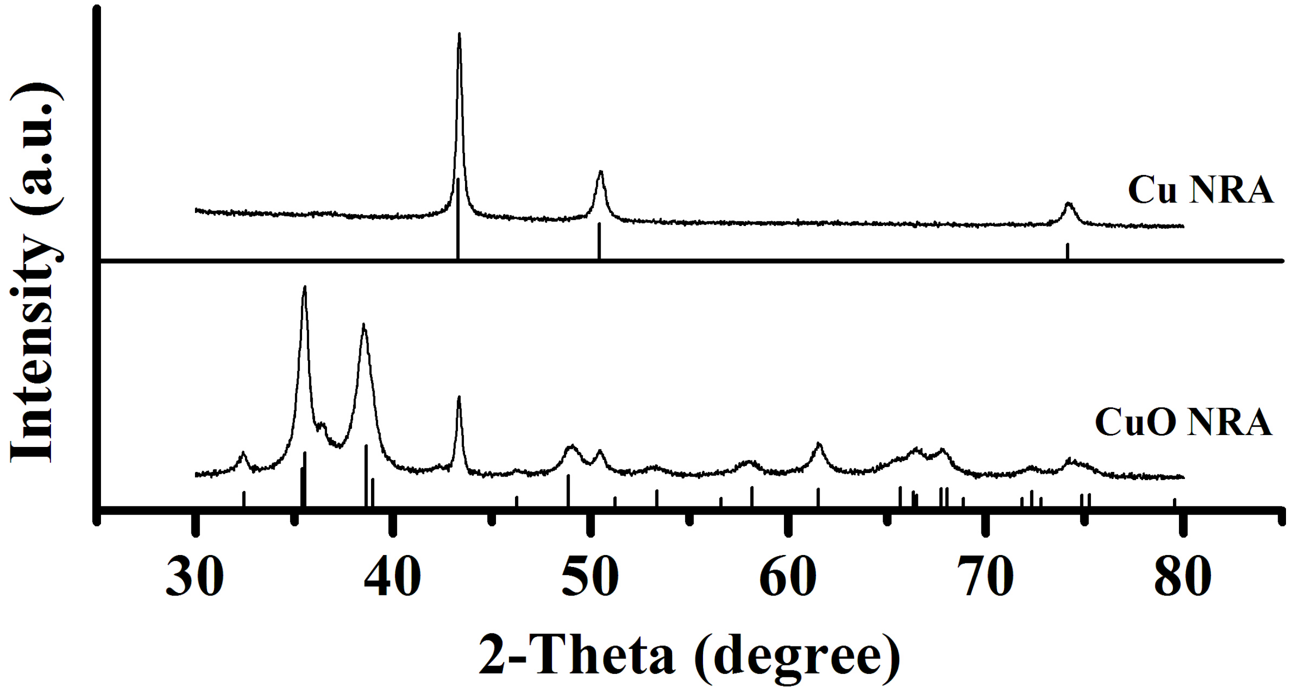

Figure S2. XRD patterns of the CuO NRA and the Cu NRA. The bottom of the image contains the JCPDS data (JCPDS no. 01-080-0076 and 004-0836) for CuO and Cu, respectively. The XRD pattern confirmed that the CuO was transformed into metallic Cu. It is further confirmed by a visible color change from black to red.

3. Morphology of the 3D array of Sn-Sb-Co alloy

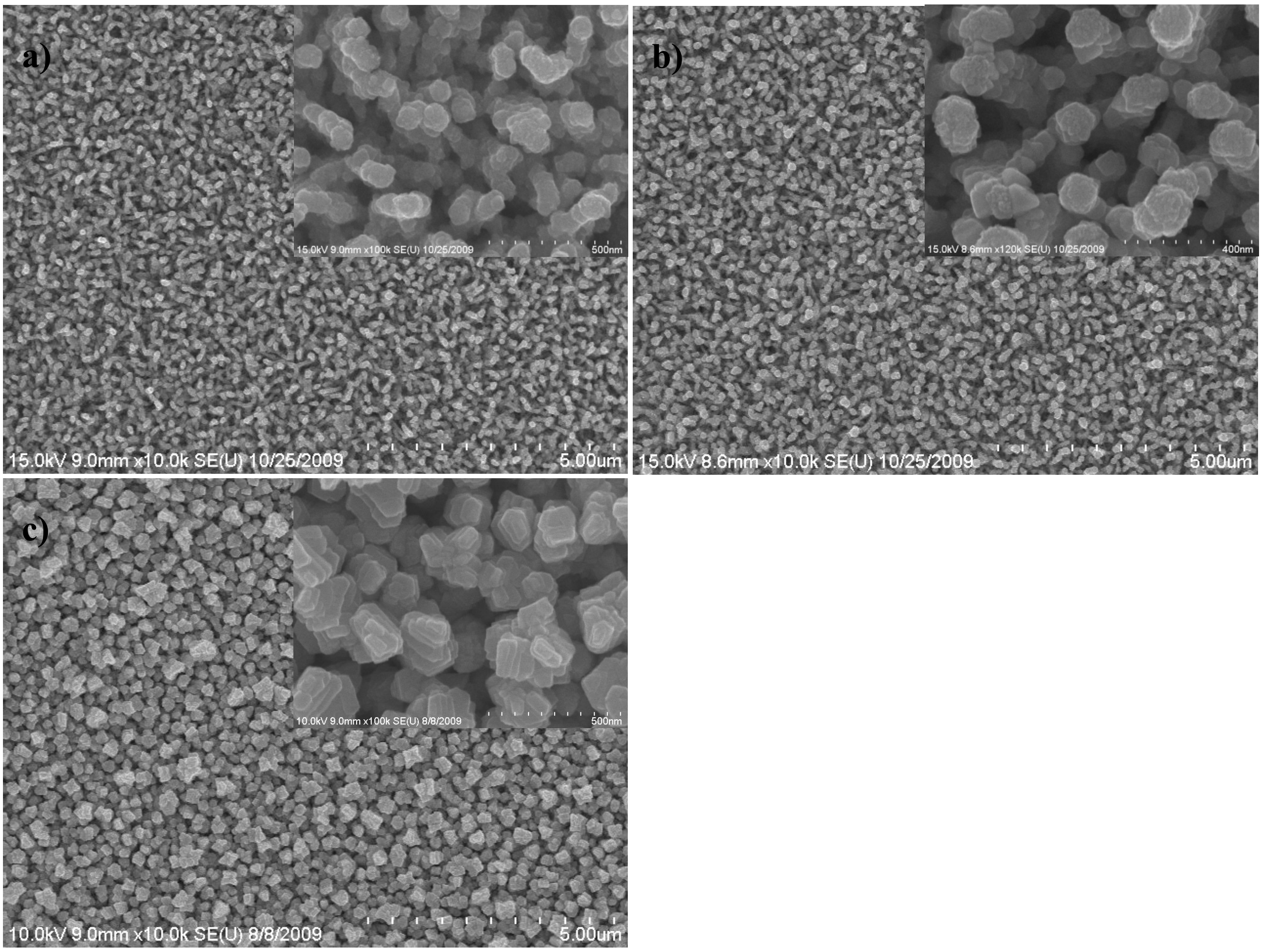

Figure S3. SEM images of (a) SnSnCo-1, (b) SnSbCo-2, and (c) SnSbCo-4. The inset shows a corresponding high-magnification image.

4. XPS characteristics of SnSbCo-3

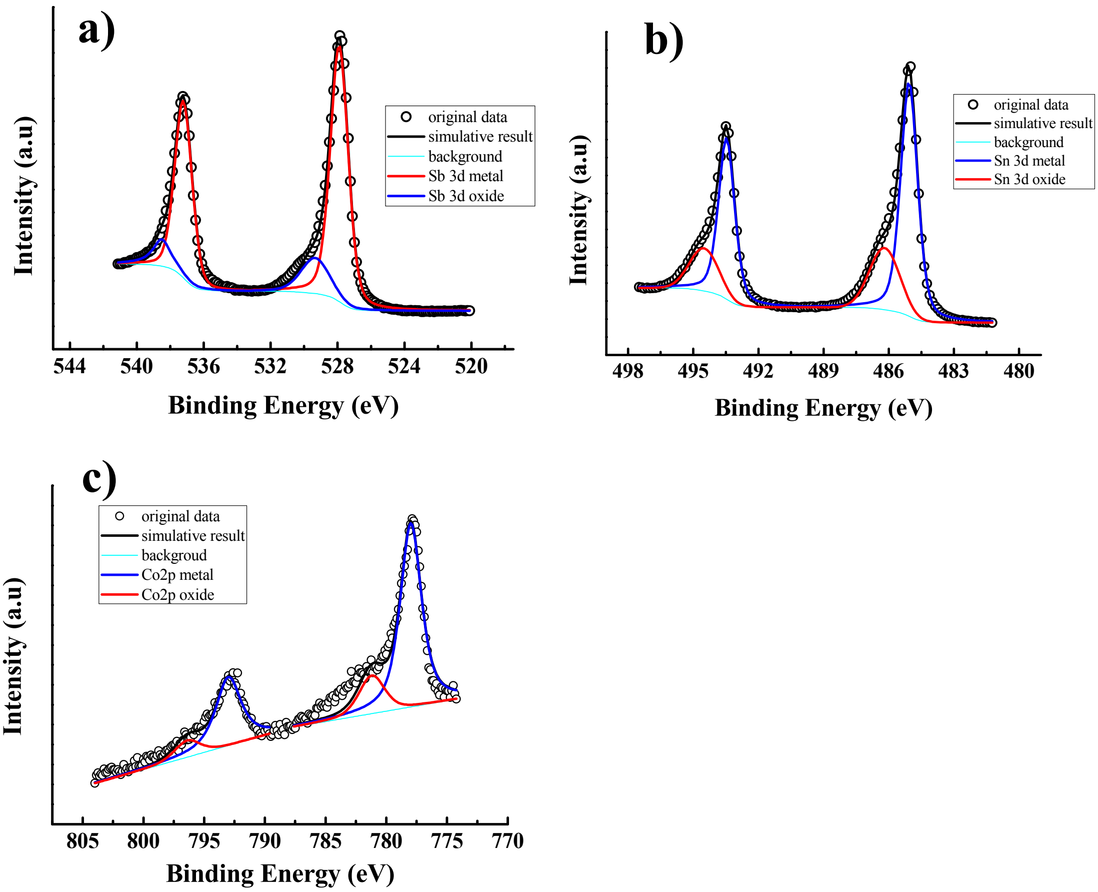

Figure S4. XPS spectra of a) Sn 3d, b) Sb 3d and c) Co 2p of the SnSbCo-3.

The surface chemical composition of SnSbCo-3 was confirmed by XPS measurements. The XPS spectra indicate the presence of some metal oxides on the surface of the SnSbCo-3 sample. Chemical analysis of the particle surfaces shows that the atomic ratio of Sn:Sb:Co is 54.5:40.5:5.0.

5. SEM and discharge/charge characteristics of 3D array of $Sn_{60}Sb_{40}$ alloy and $Sn_{75}Co_{25}$ alloy

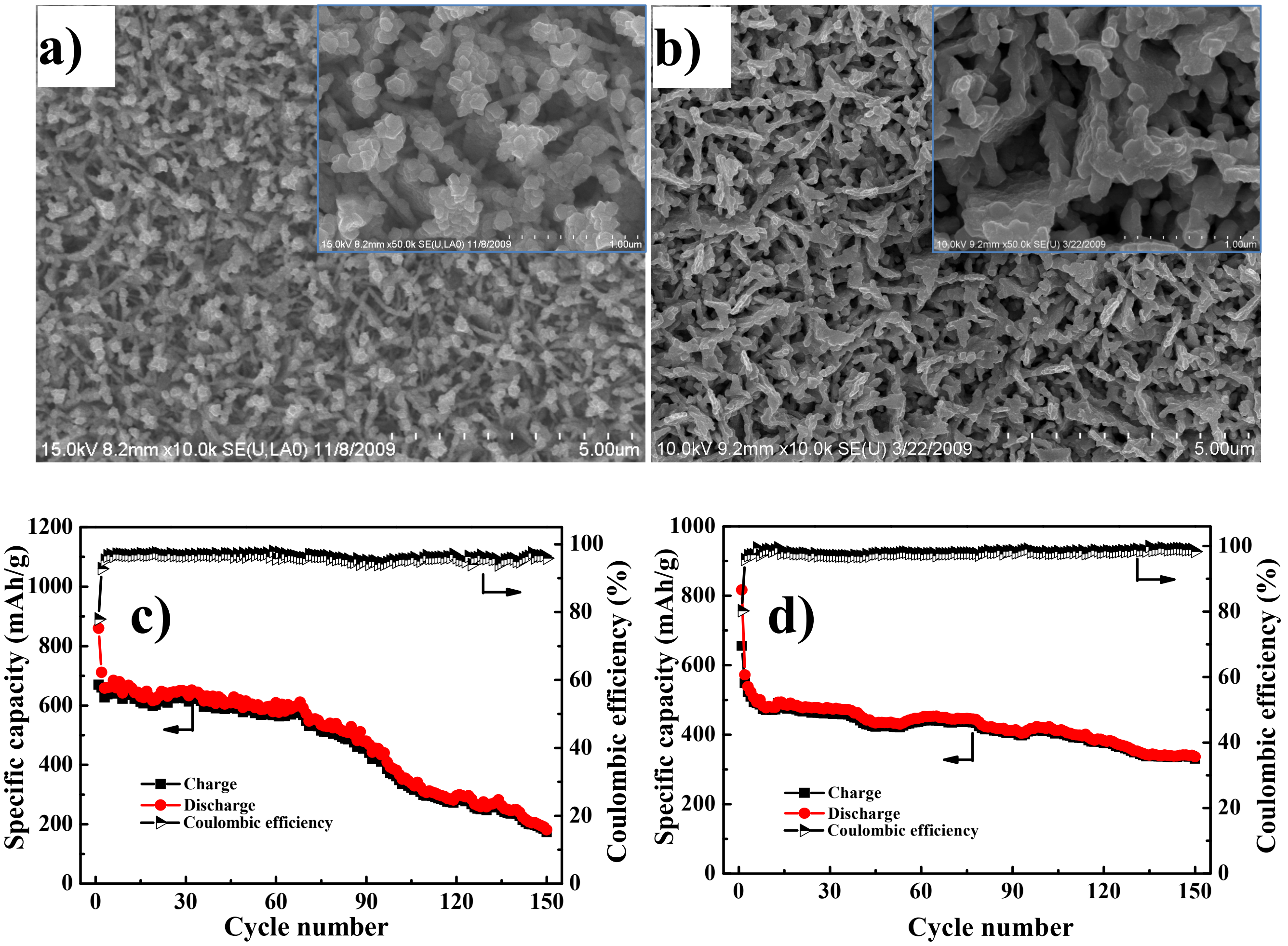

Figure S5. (a), (b) SEM images of the 3D array of $Sn_{60}Sb_{40}$ alloy and $Sn_{75}Co_{25}$ alloy electrodes, respectively. The insets show the corresponding high-magnification images. (c) and (d) Plots of the specific capacity versus cycle number of the 3D array of $Sn_{60}Sb_{40}$ alloy and $Sn_{75}Co_{25}$ alloy electrodes at a rate of 130 mA/g.

Table S1. The cycling performance data of 3D array electrodes

sample	Q_{1st} (mAh/g)	Q_{100th} (mAh/g)	Q_{150th} (mAh/g)	Q_{150th}/Q_{1st} (%)
SnSbCo-1	712.7	446.4	385.7	54.1
SnSbCo-2	719.7	403.4	407.6	56.6
SnSbCo-3	647.9	521.4	512.8	79.1
SnSbCo-4	567.9	493.2	331.4	58.4
$Sn_{60}Sb_{40}$	670.0	382.1	181.1	27.0
$Sn_{75}Co_{25}$	655.7	411.0	330.7	50.4

Q indicates the charge (lithium removal) capacity.

6. Influence of discharge-charge rate on specific capacity

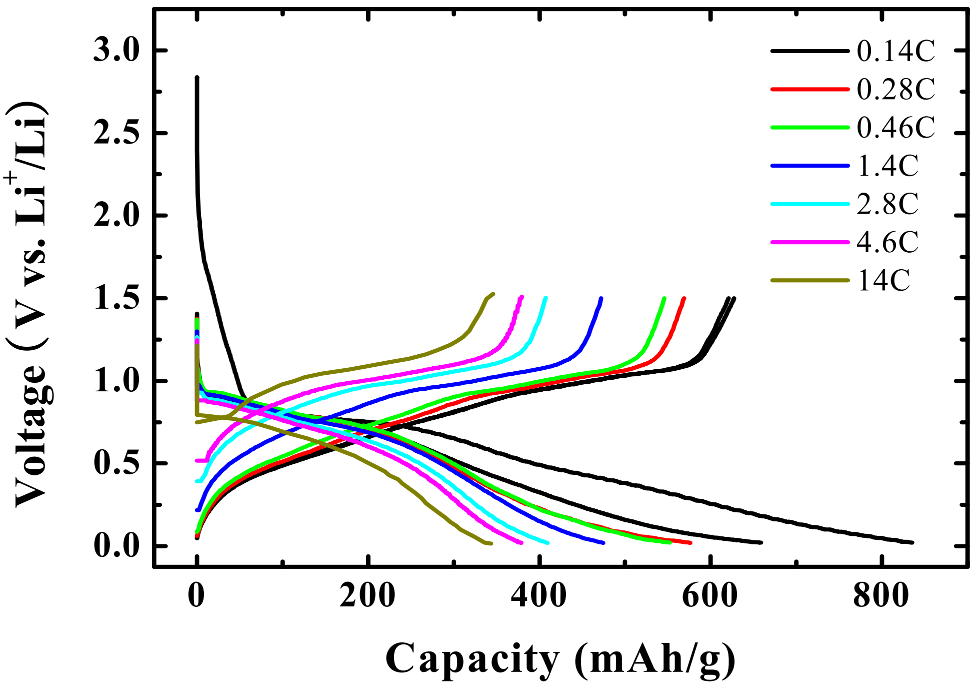

Figure S6. Stabilized discharge/charge voltage profiles of the SnSbCo-3 electrode cycled at different rates.