

Supporting Information

**Excellent Electrochemical Performance of Tin Monosulphide (SnS) as Sodium-ion
Battery Anode**

Prasit Kumar Dutta, Uttam Kumar Sen and Sagar Mitra*

Electrochemical Energy Laboratory, Department of Energy Science and Engineering

Indian Institute of Technology Bombay, Powai, Mumbai-400076, India

EDAX analysis was done on the as prepared SnS material. It was found that the atomic ratio of Sn and S in the as prepared material is around 1:1.

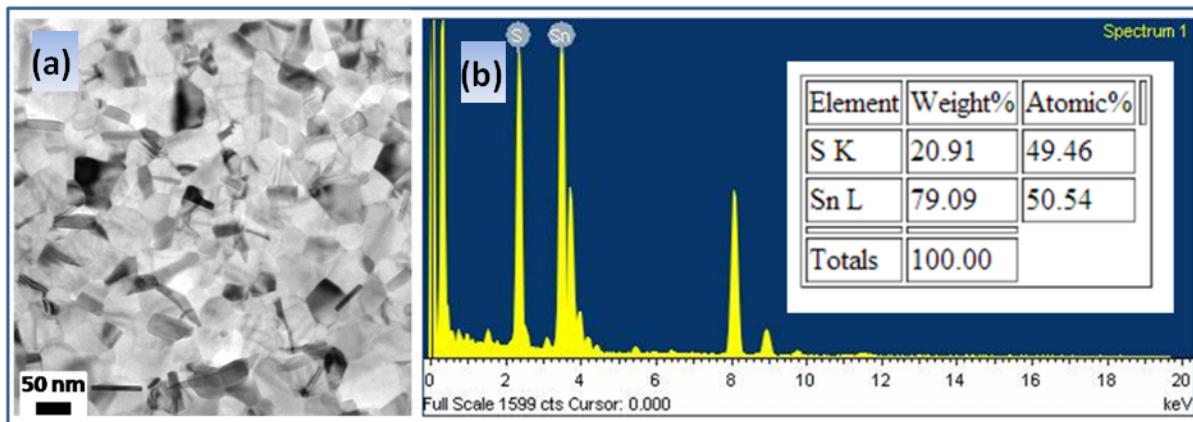


Fig S1: (a) TEM image and (b) its corresponding EDAX spectra

An electrode with 70% active material, 20% carbon and 10% binder (by wt) was prepared and its electrochemical performance was compared with the electrode having 60:20:20 composition. The comparison is shown in Fig S2.

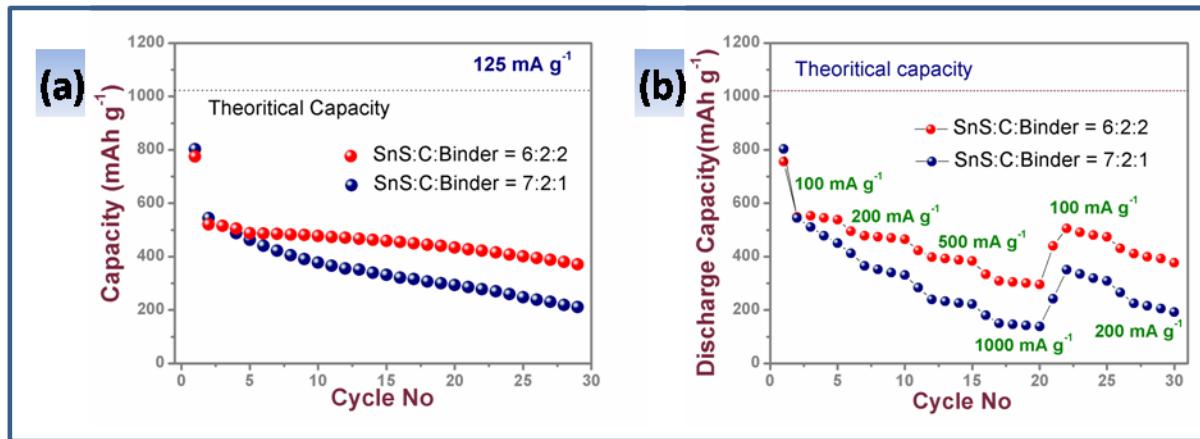


Fig S2: (a) Cycling performance and (b) rate performance of electrode material at different electrode composition

From the FEG-SEM images (Fig S3) it has been found that some plate kind of morphology was observed after 30 cycles of charge-discharge reactions which means that the morphology of the active material was changed during conversion and alloying reactions.

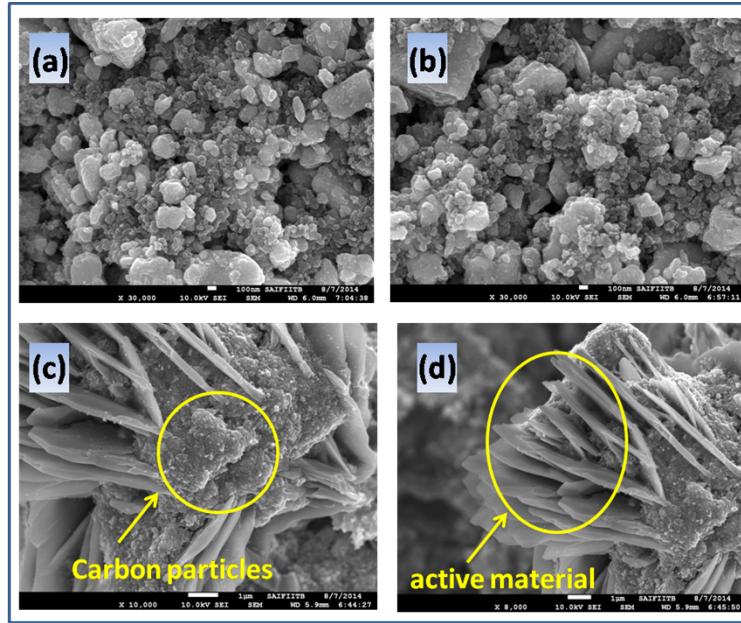


Fig S3: FEG-SEM images of the SnS electrode film (a,b) before cycling and (c,d) after 30 cycles at a current rate of 125 mA g^{-1}

Further morphological analysis has been done using FEG-TEM analysis. Due to well dispersion the particle distribution was clearly shown in the TEM images (Fig S4). The nano-rod of SnS particles were not visible after 30 cycles of charge-discharge reactions as after 1st cycle there is no existence of SnS particles as it forms nanoparticles of Sn and polysulfur after 1st cycle.

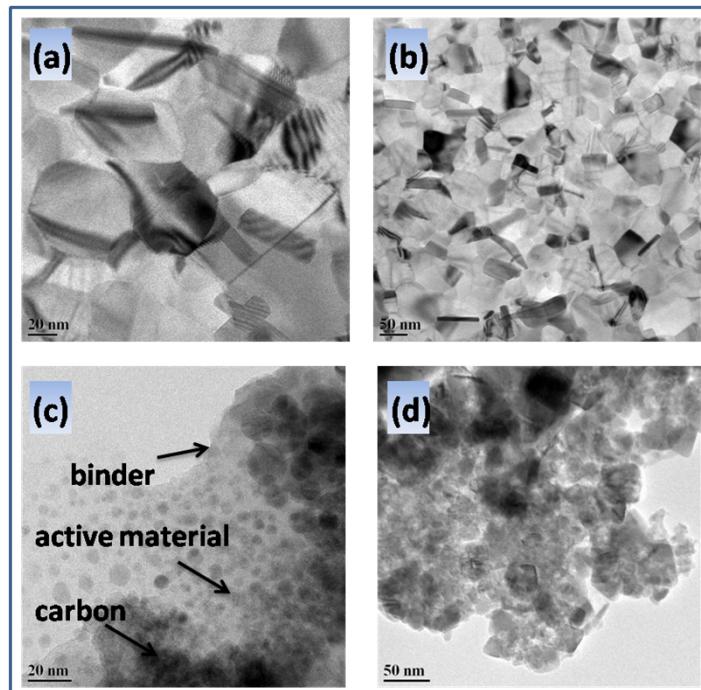


Fig S4: FEG-TEM images of the SnS electrode film (a,b) before cycling and (c,d) after 30 cycles at a current rate of 125 mA g⁻¹

Table T1: Fitted parameters for equivalent circuits for PEIS shown in fig 3.

| | Voltages (V) | R ₁ (Ohm) | R ₂ (Ohm) | R ₃ (Ohm) |
|-----------|-----------------|-------------------------|-------------------------|-------------------------|
| Discharge | OCV | 6.891 | 107.8 | - |
| | 0.8 | 9.47 | 153.6 | - |
| | 0.5 | 10.29 | 195.7 | - |
| | 0.3 | 10.55 | 200.4 | - |
| | 0.1 | 11.23 | 210 | - |
| Charge | 0.5 | 10.37 | 216 | - |
| | 0.8 | 11.29 | 219.8 | - |
| | 1.2 | 10.7 | 253.9 | - |
| | 1.5 | 9.818 | 149.4 | 156.6 |
| | 2.0 | 10.03 | 159 | - |