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

Fabrication of One-dimensional $SnO_2/MoO_3/C$ Nanostructure Assembled of Stacking SnO_2 Nanosheets from Its Heterostructure Precursor and Its Application in Lithium-Ion Batteries

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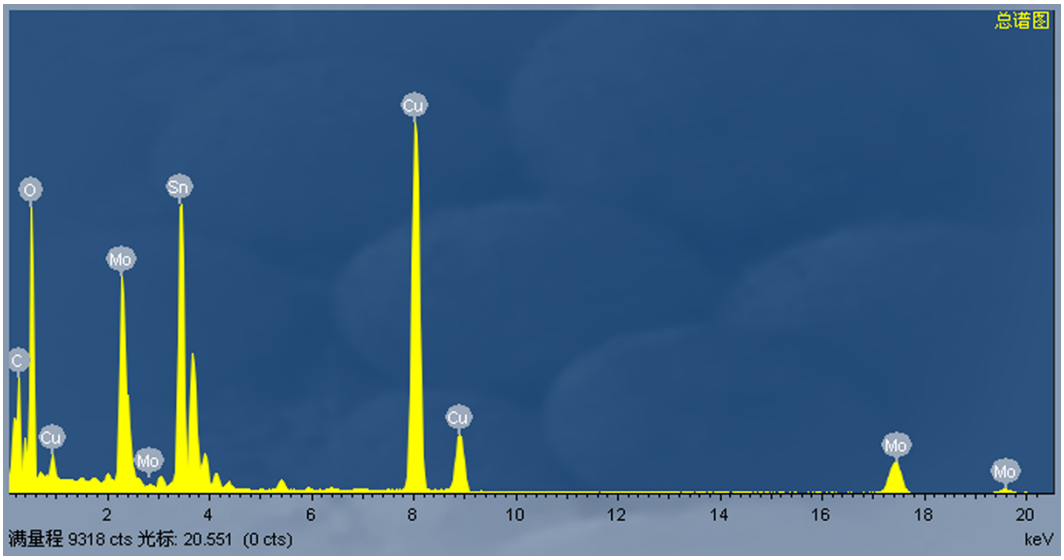

Figure S1. EDS spectrum attached to the $SnO_2/MoO_3/C$ nanocomposites

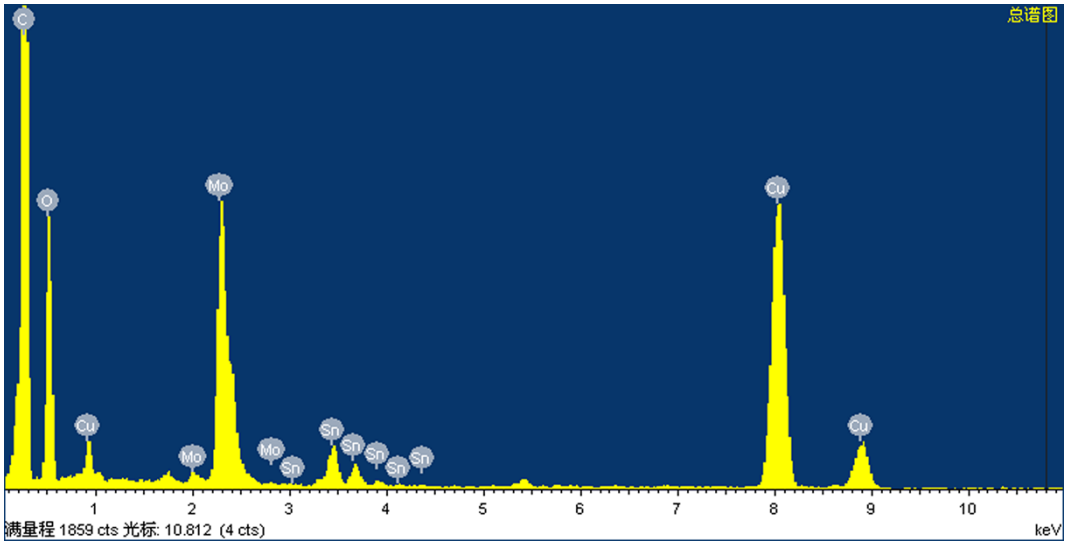

Figure S2. EDS spectrums attached to the TEM of S_{6h}

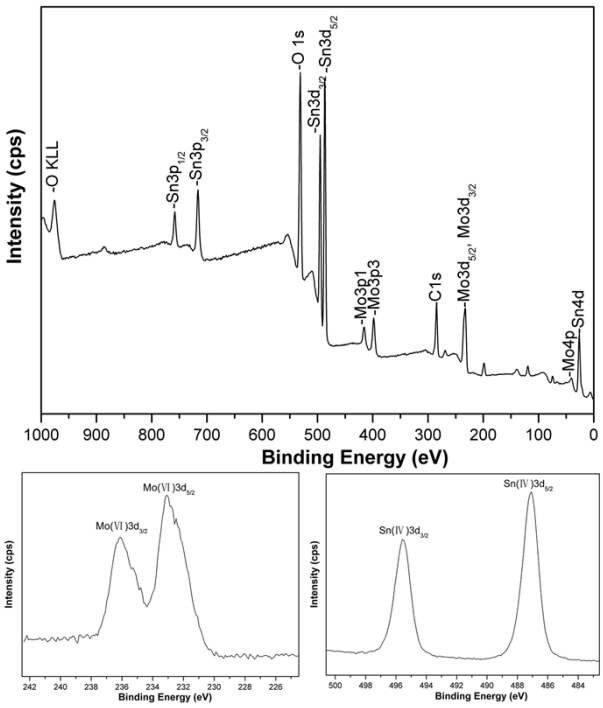

Figure S3. (a) Full-range XPS spectrum of the SnO_2/MoO_3 nanocomposites before carbon coating; (b) the Mo(Ⅵ) 3d spectrum and (c) Sn(Ⅳ) 3d spectrum.

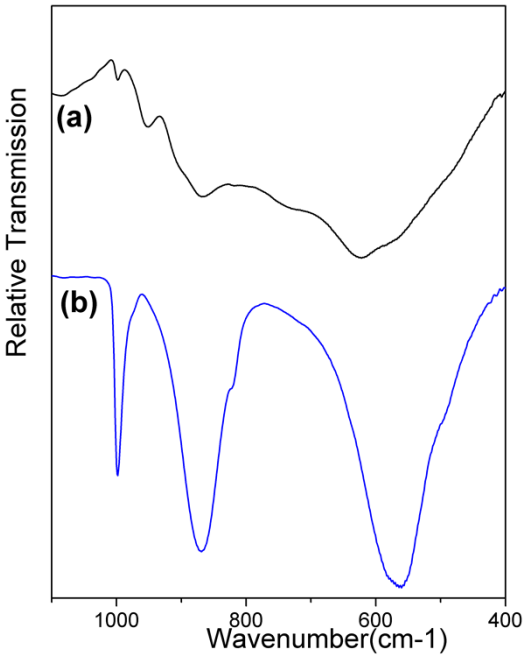

Figure S4. FTIR spectra of (a) the SnO_2/MoO_3 nanocomposites before carbon coating, (b) pure crystalline α-MoO_3

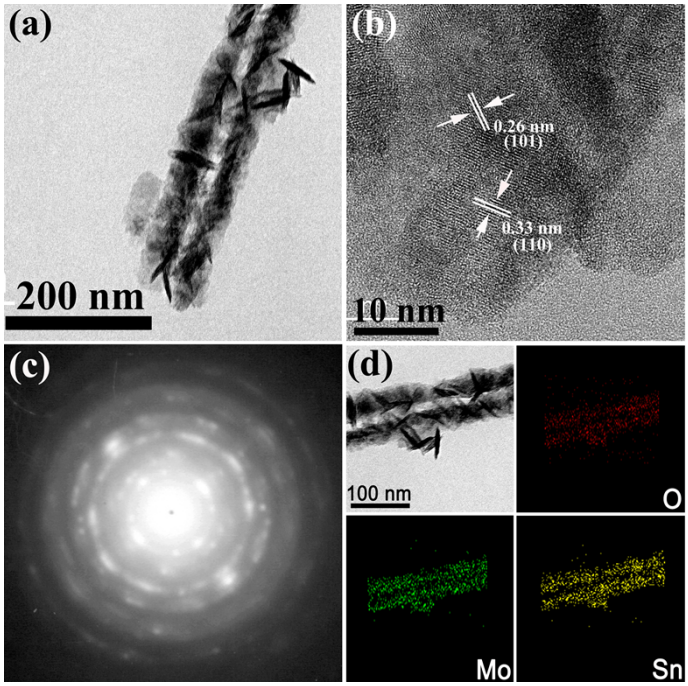

Figure S5. (a) Lower-magnification TEM image of the 1-D SnO_2/MoO_3 nanocomposites before carbon coating; (b) HRTEM image of the circular area in (a); (c) Corresponding SAED pattern; (d) corresponding EDS mapping images of O (red), Mo (green), Sn (yellow) and C (purple), respectively

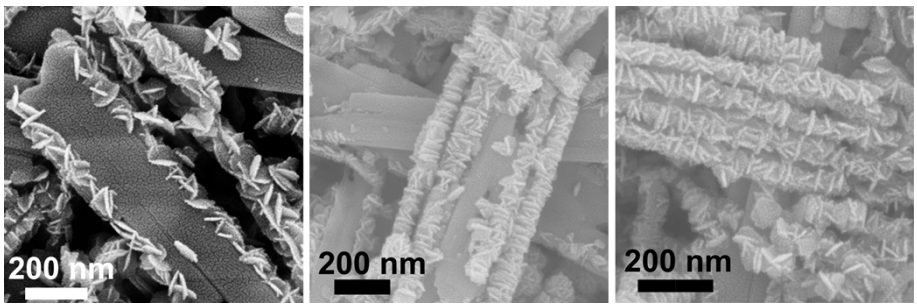

Figure S6. Typical SEM images of the obtained products at various reaction stages by setting the reaction time at the temperature of 150 ^{o}C

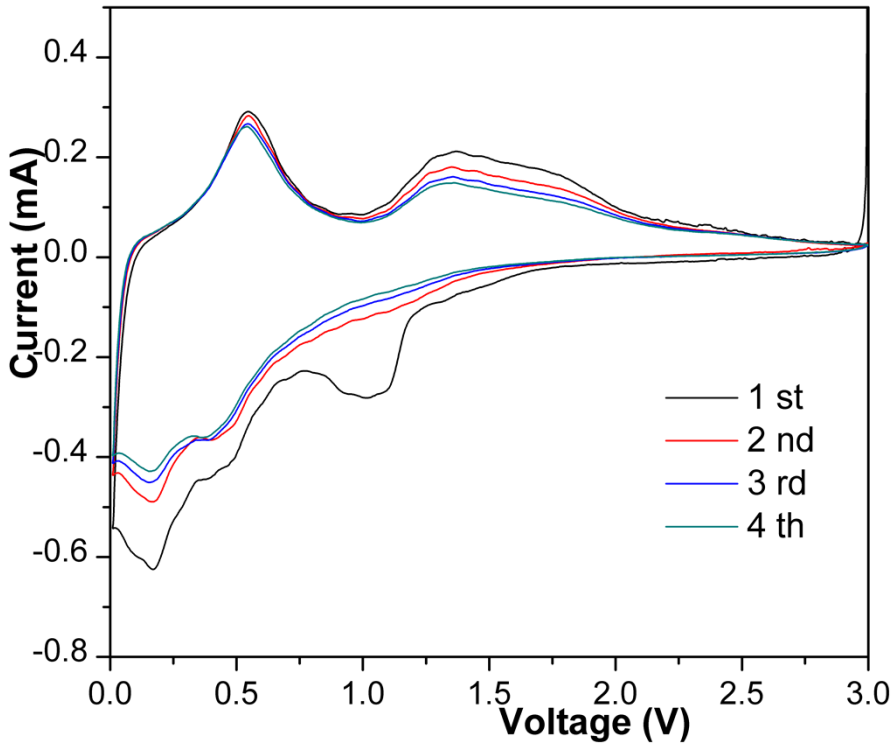

Figure S7. The first four cyclic voltammogram (CV) curves of SnO_2/MoO_3/C nanocomposite electrode in the potential range of 0.001-3.0 V at a slow scan rate of 0.2 mV s^{-1}.

Figure S7 is the first four cyclic voltammogram (CV) curves of SnO_2/MoO_3/C nanocomposite electrode in the potential range of 0.001-3.0 V at a slow scan rate of 0.2 mV s^{-1}. The shape of the CV curves of SnO_2-MoO_3 is similar to the main part nanocrystalline SnO_2. It is generally accepted that the electrochemical process of SnO_2 anodes can be described by the two principal reactions: (1) $SnO_2 + 4Li^+ + 4e^- \rightarrow Sn +$

$2Li_2O$; (2) $Sn + xLi^+ + xe^- \leftrightarrow Li_xSn$ ($0 \leq x \leq 4.4$). In the first sweep, the broad cathodic peak around 1.0 V could derive from Li_2O formation and electrolyte decomposition when SnO_2 nanosheets react with Li^+ as described in Equation (1). The formation of a solid electrolyte interface (SEI) layer may be another factor. From the second cycle the peak disappeared since the process of SnO_2 to Sn is generally believed to be irreversible. However, this cathodic peak, together with the anodic peak at 1.3 V, is still present in subsequent cycles, indicating partially reversibility of the reaction. The characteristic pair of current peaks is observed at potentials (cathodic/anodic) of 0.15/0.58 V in the four cycles. This is attributed to the alloying (cathodic sweep) and dealloying (anodic sweep) processes between Li and Sn, the Equation (2), which are observed to be highly reversible and mainly responsible for the reversible lithium storage capacity in Sn-based electrode materials. Different from the typical CV curves of SnO_2, the cathodic peak at about 0.40 V exists, which could be attributed to the reduction of Li_xMoO_3 to metal Mo and described by the reaction $Li_xMoO_3 + (6-x)\ Li^+ + (6-x)\ e^- \leftrightarrow Mo + 3\ Li_2O$. The anodic peak centered at 1.5 V can be assigned to the extraction process of lithium.

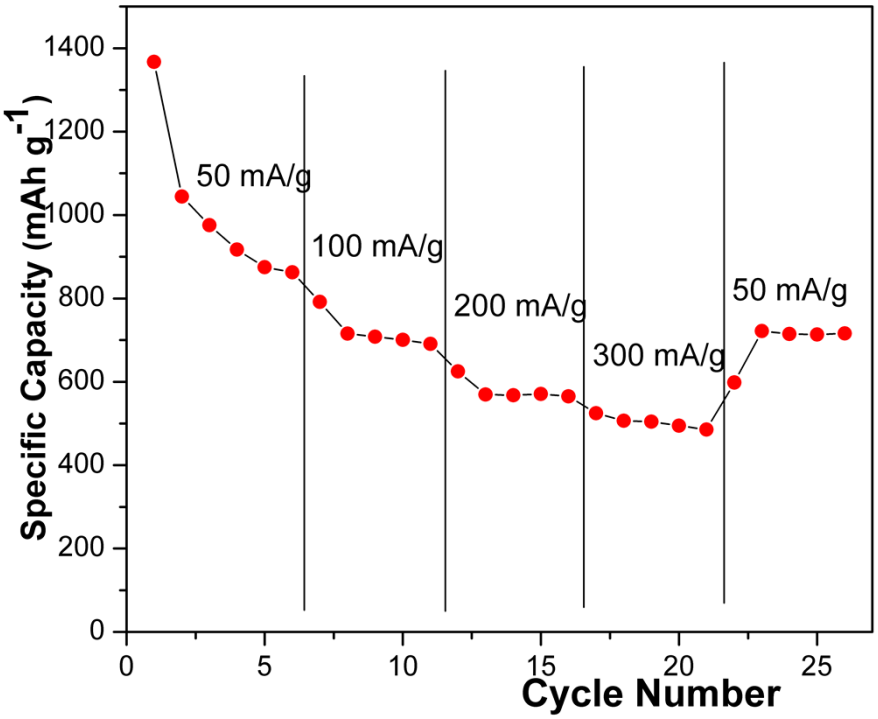

Figure S8. Specific capacities of the $SnO_2/MoO_3/C$ nanocomposite electrode for different

discharge/charge cycles at various current densities.

The cell with the $SnO_2/MoO_3/C$ nanocomposite electrode was evaluated for rate capability and the results are shown in Figure S8. When the current rate was first increased from 50 to 100 mA g^{-1}, a stable capacity of around 780 mAh g^{-1} could be achieved. Afterwards, the rate was increased stepwise up to 300 mA g^{-1}, the electrode could still deliver a stable capacity of about 500 mAh g^{-1}. Upon decreasing the current rate to 50 mA g^{-1}, a capacity of around 720 mAh g^{-1} can be recovered.

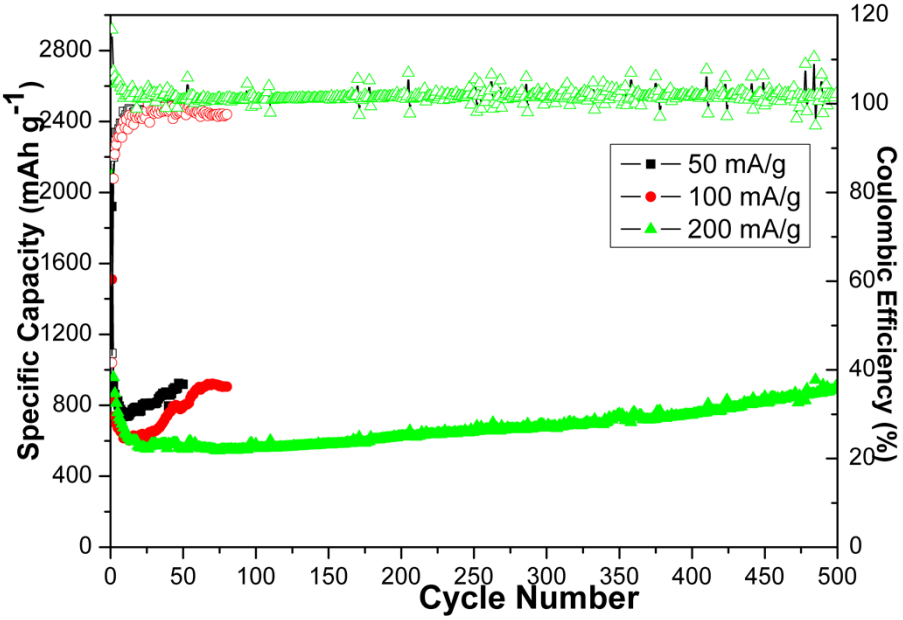

Figure S9. Cycling performance and coulombic efficiency of $SnO_2/MoO_3/C$ nanocomposites at different current rates within a voltage window of 0.01–3.0 V.