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Supporting information

Graphene-Based Carbon Coated Tin Oxide as Lithium Ion Battery Anode Material with High Performance

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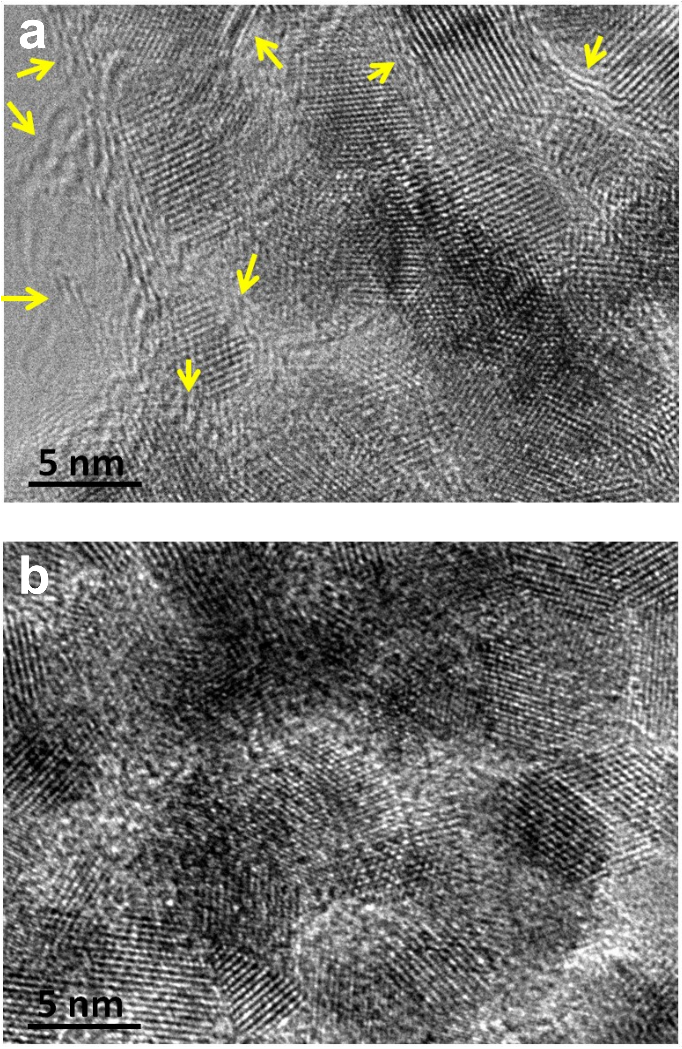

Figure S1. TEM images of rGO/PC/SnO_2 (a) and rGO/SnO_2 (b) samples, respectively. The carbon of rGO/PC/SnO_2 sample was indicated by the yellow arrows in (a). The interfaces between the crystallized SnO_2 particles of rGO/PC/SnO_2 (a) are filled with carbon, which can prevent the agglomeration of SnO_2 nanoparticles and limit their volume expansion during the circulation used as the LIB anode, thus greatly increasing the cyclic stability.

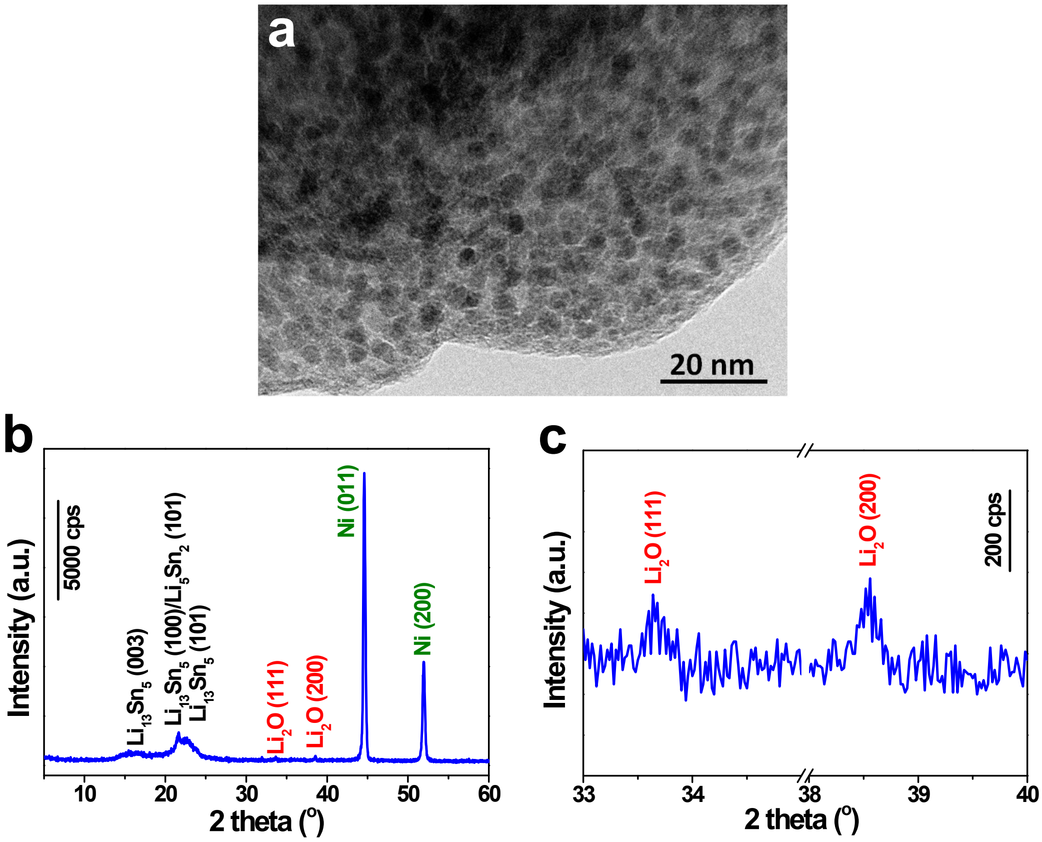

Figure S2. TEM image (a) and XRD patterns (b and c) of rGO/PC/SnO_2 electrode material measured after 150 cycles at 0.1 C. The Li_xSn alloy with the size of about 5-8 nm could be found (a). The typical XRD peaks of $Li_{13}Sn_5$ (PDF#29-0838; Hexagonal, *P*-3m1 (164)) and Li_5Sn_2 (PDF#29-0839; Hexagonal, *R*-3m (166)) could be observed (b). And the peaks corresponding to the (111) and (200) lattice planes of Li_2O (PDF#12-0254; Cubic, *F*m-3m (225)) could be found in the enlarged XRD patterns (c). The strong 2θ peaks located at 44.50° and 51.90° (b) are corresponding to the Ni (011) and (200) lattice planes, since the active material is coated on the nickel foam.

As to the SnO_2 based sample, two steps of electrochemical reactions occurred in the discharging process: (i) the SnO_2 irreversibly reduced to metallic Sn and Li_2O and (ii) the reversible Li-Sn alloying reaction. The resultant small nanosized Li_xSn alloy including primary $Li_{13}Sn_5$ and Li_5Sn_2 is due to the coated carbon which can prevent the volume expansion and the detrimental aggregation of the Sn clusters, thereby ensuring that the electrode will not break and electrons and lithium ions can transport easily, thus leading to an excellent cyclic stability of the rGO/PC/SnO_2 electrode material when using as the LIB cathode.