Electronic Supplementary Information

Electronic Supplementary Materials for Chemical Communications

SnO_2 nanocrystals anchoring on N-doped graphene for high-performance lithium storage

Wei Zhou[a], Jinxian Wang[a,b], Feifei Zhang[a,c], Shumin Liu[a], Jianwei Wang[a], Dongming Yin[a], Limin Wang[a,d,*]

[a]State Key Laboratory of Rare Earth Resource Utilization, Changchun Institute of Applied Chemistry, Chinese Academy of Sciences, Changchun 130022, China.
[b]School of Chemistry and Environmental Engineering, Changchun University of Science and Technology, Changchun 130022, China.
[c]University of Chinese Academy of Sciences, Beijing 100049, China.
[d]Changzhou Institute of Energy Storage Materials and Devices, Changzhou, 213000, China.
* Corresponding author. Tel.: +86 431 85262447. Fax: +86 431 85262836. *E-mail address:* lmwang@ciac.ac.cn

Supplementary Materials

Experimental details

Materials Preparation

Graphite oxide was produced by a modified Hummers method.[1] Graphene oxide suspension (2 mg mL^{-1}) was prepared by dispersing 60 mg graphite oxide into a mixed solution, which contained 20 mL DI water and 10 mL ethylene glycol. Then, 1 g urea and 0.3 g $SnCl_4 \cdot 5H_2O$ were dissolved into the above solution. The solution was transferred into an autoclave and heated by microwave (MARS6, CEM Corporation, USA) to reach 180 °C and kept for 5 minutes. After naturally cooled, obtained black precipitate was rinsed several times by DI water and absolute ethanol. Last, it was dried under vacuum at 80 °C overnight. For comparison, pristine SnO_2 nanocrystals were obtained by the same process without the addition of graphene oxide.

Materials Characterization

The structure and morphology of the products were characterized by X-ray diffraction (Bruker D8 Focus diffractometer with Cu Kα radiation) and transmission electron microscope (FEI Tecnai G2). Thermogravimetric analysis (TGA) was performed on a NETZSCH STA 449F3 simultaneous thermal analyzer in air with a heating rate of 10 $^oC\ min^{-1}$. X-ray photoelectron spectroscopy (XPS) analysis was carried out using an ESCALABMKLL X-ray photoelectron spectrometer with monochromatic Al Kα source.

Electrochemical measurements

A *N*-methyl pyrrolidinone (NMP) slurry consisting of the active material, carbon black and polyvinylidene difluoride (PVDF) with a weight ratio of 8:1:1 was pasted on a copper foil. After drying, the foil was punched into disk electrodes. The electrodes were vacuum dried, weighted and assembled into 2025 coin-type cells, with Li-foil as counter electrode and Celgard 2400 membrane as separator. The electrolyte was 1M $LiPF_6$ dissolved in a 1:1 (v/v) mixture of ethylene carbonate (EC) and diethyl carbonate (DEC). The cells were galvanostatic cycled between 0.01 and 3V *versus* Li metal at various C rates using LAND CT2001A battery testing system.

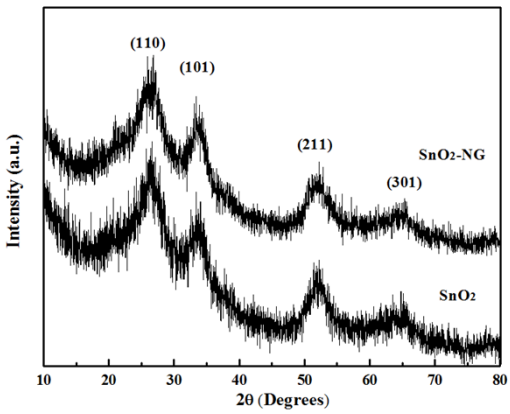

Fig. S1 XRD patterns of SnO_2 nanocrystals and SnO_2/N-doped graphene composite.

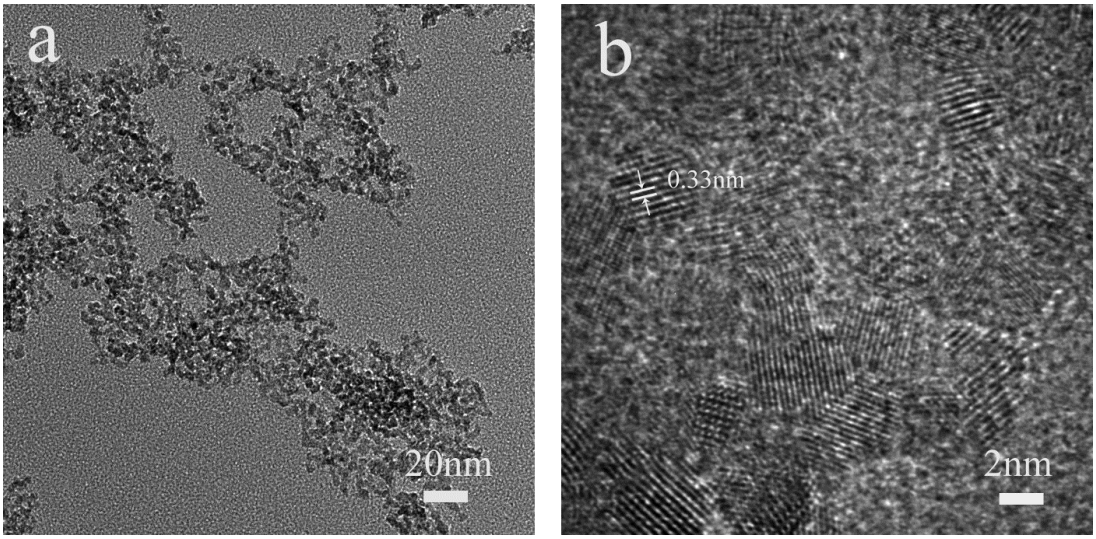

Fig. S2 TEM (a) and HRTEM (b) images of SnO_2 nanocrystals.

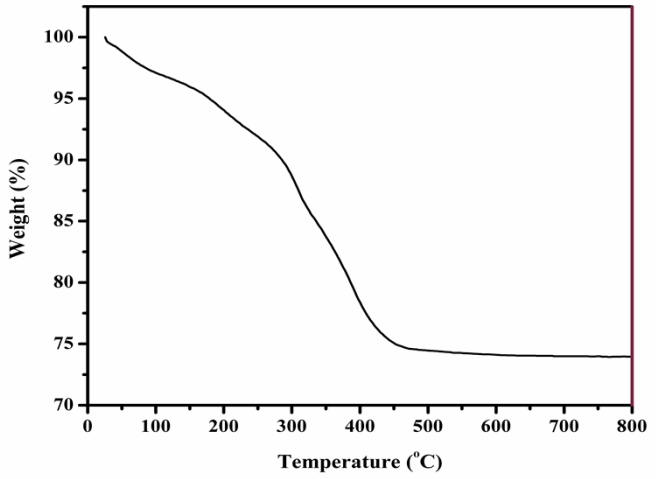

Fig. S3 TGA curve of SnO_2/N-doped graphene composite.

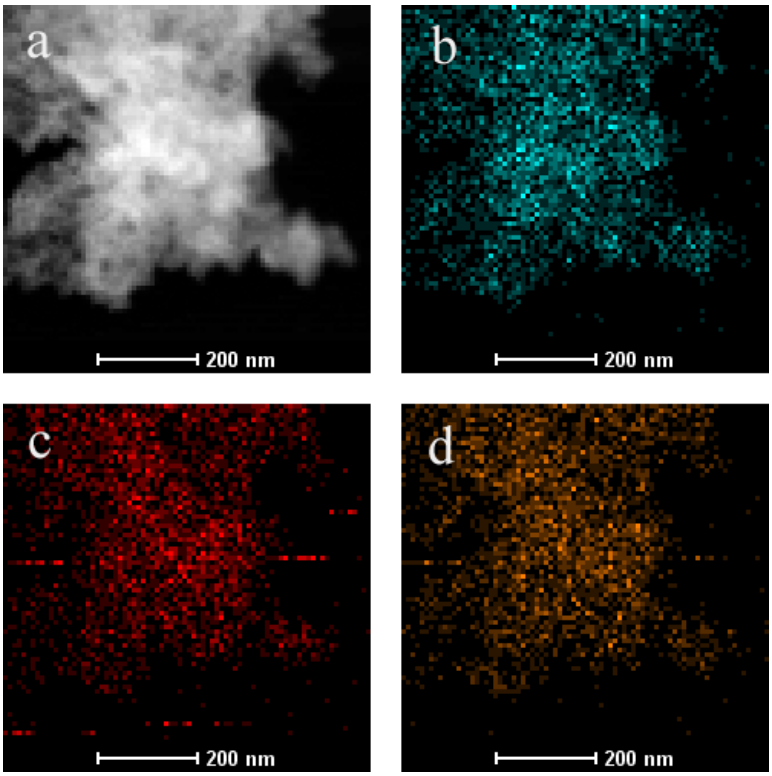

Fig. S4 STEM image (a), Sn (b), C (c) and N (d) elemental mappings of SnO_2/N-doped graphene composite.

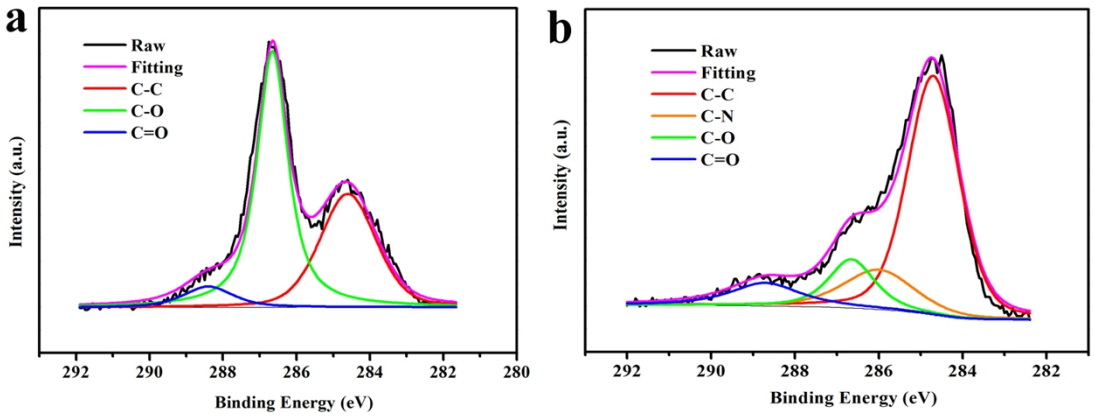

Fig. S5 C1s XPS spectra of GO (a) and SnO_2/N-doped graphene composite (b).

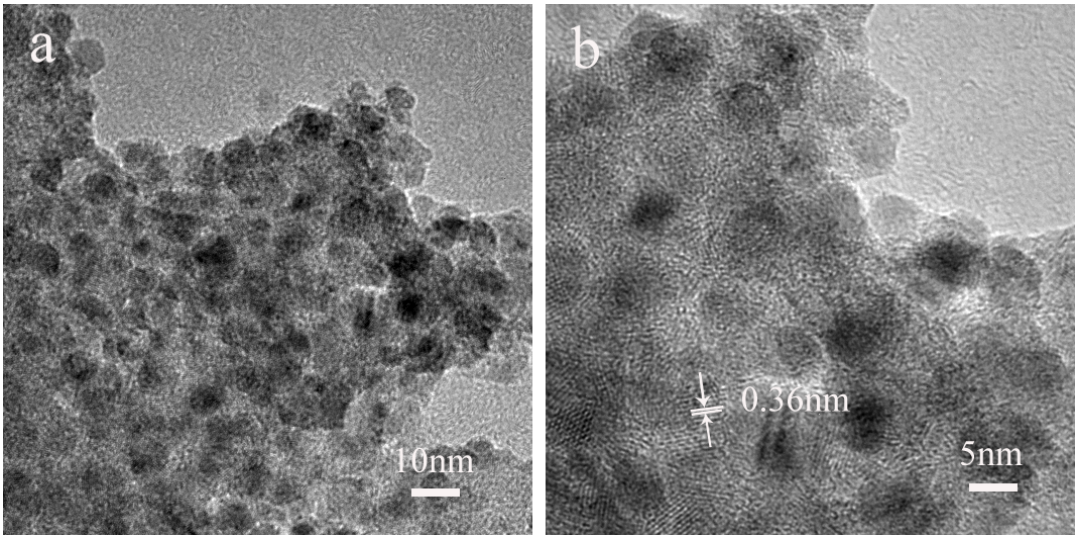

Fig. S6 TEM (a) and HRTEM (b) images of SnO_2/N-doped graphene composite electrode after 1C cycling.

References

1. D.C. Marcano, D.V. Kosynkin, J.M. Berlin, A. Sinitskii, Z.Z. Sun, A. Slesarev, L.B. Alemany, W. Lu and J.M. Tour, *ACS Nano*, 2010, **4**, 4806.