

Supplementary Information

Synthesis of Cambered Nano-walls of SnO₂/rGO Composites Using a Recyclable Melamine Template for Lithium-Ion Batteries

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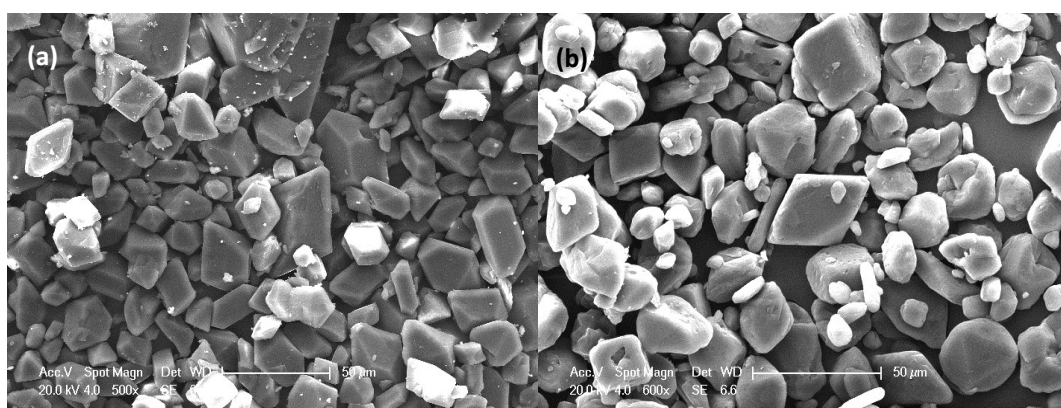


Fig. S1 Melamine powders before (a) and after (b) soaking in pure water at room temperature.

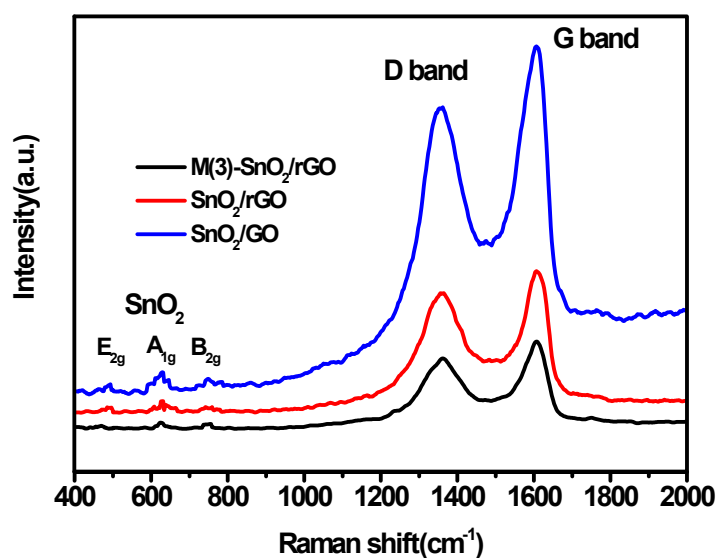


Fig. S2a Raman spectra of the M(3)-SnO₂/rGO, SnO₂/rGO and SnO₂/GO composites.

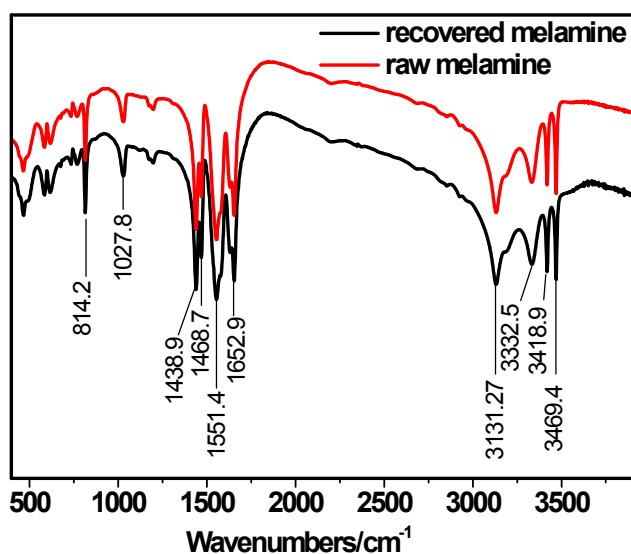


Fig. S2b The FTIR spectra of the original melamine and the recovered melamine from melamine@SnO₂/rGO.

It indicated that the melamine has no changes during synthesis with acting as template. The intense bands at 3470-3120 cm⁻¹ assigned to typical stretching vibration modes of N-H, 1651 cm⁻¹ assigned to N-H bending vibration and 1027 cm⁻¹ due to N-H torsional vibration. The bands at 1551-1436 cm⁻¹ correspond to the stretching vibration of triazin ring. The spectrum depicted a peak at 814 cm⁻¹ which corresponds to the deformation vibration absorption of triazin ring.¹

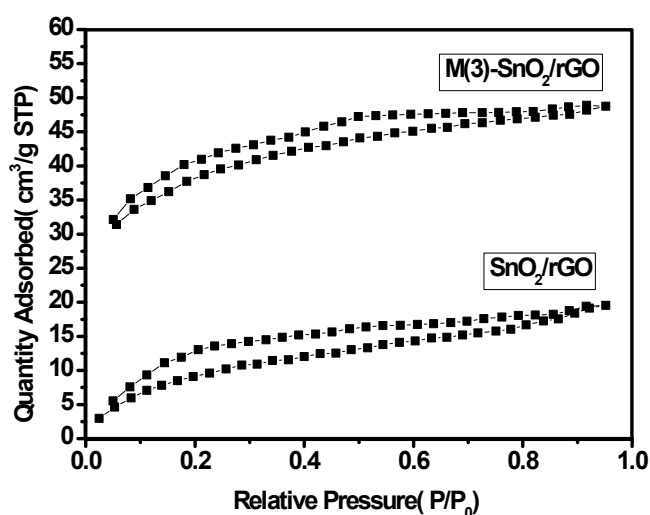


Fig. S3 Nitrogen adsorption–desorption isotherms of M(3)-SnO₂/rGO and SnO₂/rGO.

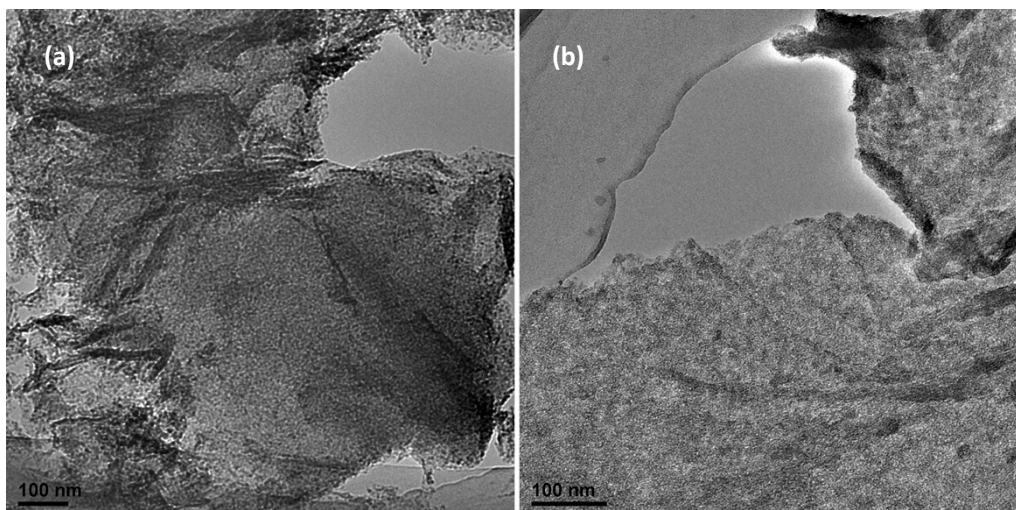


Fig. S4 TEM images of SnO₂/rGO (a) and M(3)-SnO₂/rGO (b).

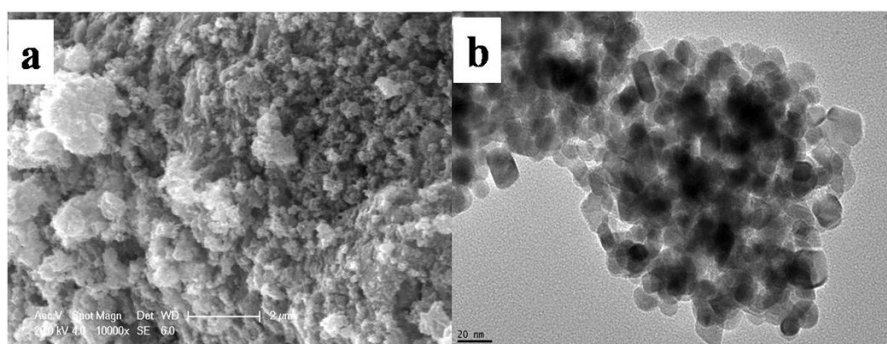


Fig. S5 SEM (a) and TEM (b) images of bare SnO₂.

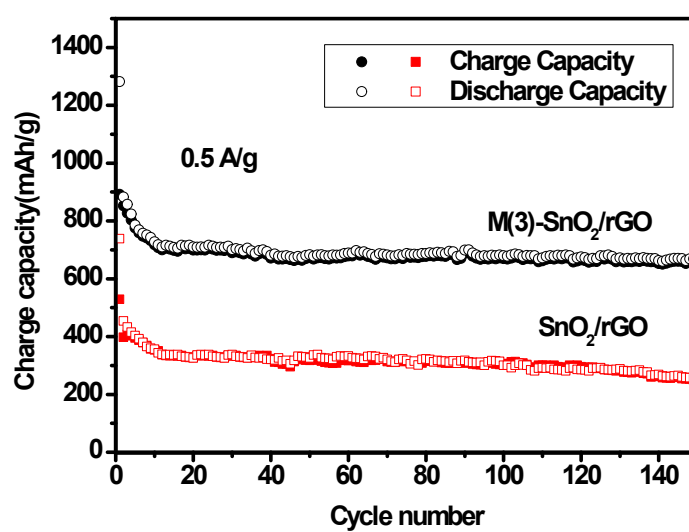


Fig. S6 Plots of charge capacities of M(3)-SnO₂/rGO and SnO₂/rGO composites during cycling at a current density of 0.5 A/g between 0.02-3.00V.

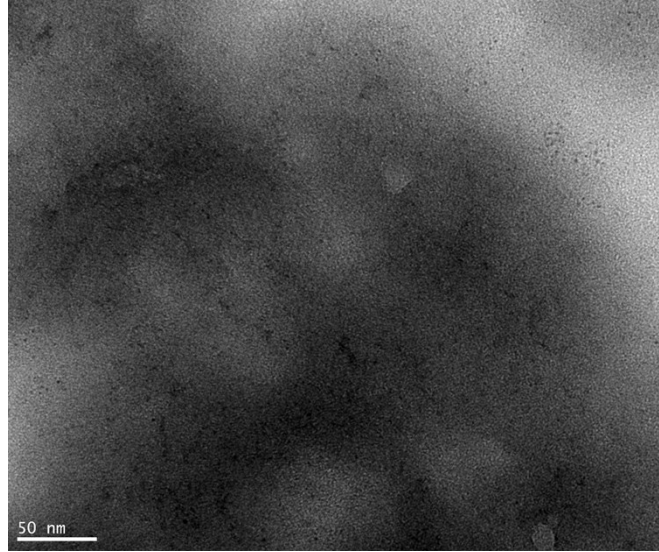


Fig. S7 TEM image of the M(3)-SnO₂/rGO sample torn off from the electrode after 100 charge/discharge cycles at a current density of 0.1 A/g between 0.02-3.00V.

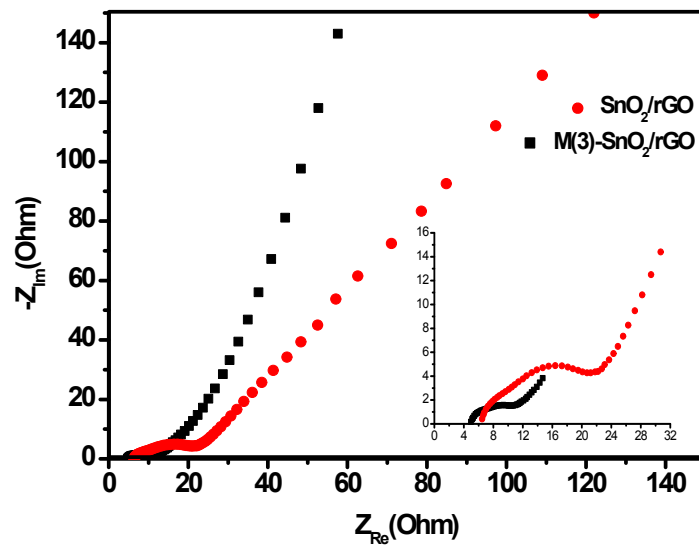


Fig. S8 AC impedance spectra of the M(3)-SnO₂/rGO and SnO₂/rGO electrodes after 100 charge/discharge cycles at a current density of 0.1 A/g between 0.02-3.00V.

The lithium ion diffusion coefficient can be calculated from the formula as following:

$$D = R^2 T^2 / 2 A^2 n^4 F^4 C^2 \sigma^2$$

Where A is the surface area of the electrode, n is the number of the electrons per molecule attending the electronic transfer reaction, F is the Faraday constant, C is the concentration of lithium ion in electrode, R is the gas constant, T is the room temperature in our experiment, σ is the slop of the line $Z_{Re} \sim \omega^{-1/2}$, respectively.²⁻⁴

Table. S1 The charge and discharge performance of M(x)- SnO₂/rGO, SnO₂/rGO and bare SnO₂.

Material	Initial charge capacity (mAh/g)	Initial discharge capacity (mAh/g)	Initial coulombic efficiency (%)	100 th charge capacity (mAh/g)
M(5)-SnO ₂ /rGO	1000.2	1567.8	63.8	845.7
M(3)-SnO ₂ /rGO	998.1	1556.8	64.1	854.9
M(2)-SnO ₂ /rGO	963.8	1560.9	61.7	744.6
M(1)-SnO ₂ /rGO	872.4	1490.8	58.5	687.2
SnO ₂ /rGO	738.7	1670.7	44.2	535.8
SnO ₂	884.7	1474.8	47.9	30.8

References

- 1 N. E. Mircescu, M. Oltean, V. Chiş and N. Leopold, *Vibrational Spectroscopy*, 2012, **62**, 165-171.
2. X. Zhou, J. Shi, Y. Liu, Q. Su, J. Zhang and G. Du, *Journal of Alloys and Compounds*, 2014, **615**, 390-394.
3. S. Li, B. Wang, J. Liu and M. Yu, *Electrochimica Acta*, 2014, **129**, 33-39.
4. Y.-J. Gu, Z. Guo and H.-Q. Liu, *Electrochimica Acta*, 2014, **123**, 576-581.