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Supplement Information

Three dimensional carbon/ZnO nanomembranes foam as lithium-ion anode with long-life and high areal capacity

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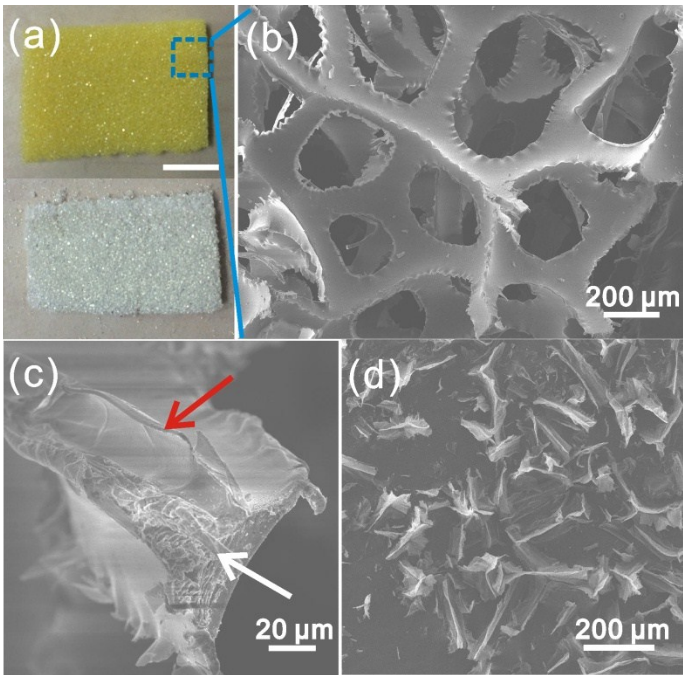

Fig. S1 (a) The photos of the template coated by ZnO NM (400 ALD cycles) before (yellow) and after (white) annealed at 700 °C in O_2 atmosphere. (b) SEM image of the interconnected porous structure of the template coated with a uniform layer of ZnO (before annealing). (c) SEM image of a cross section of the sample. White arrow: polymer template. Red arrow: ZnO NMs. (d) SEM image of ZnO NMs after annealing.

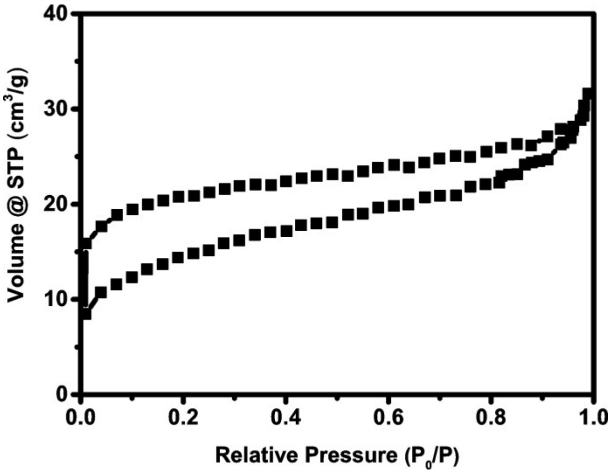

Fig. S2 Nitrogen adsorption−desorption isotherms of carbon foam pyrolyzed at 700 °C.

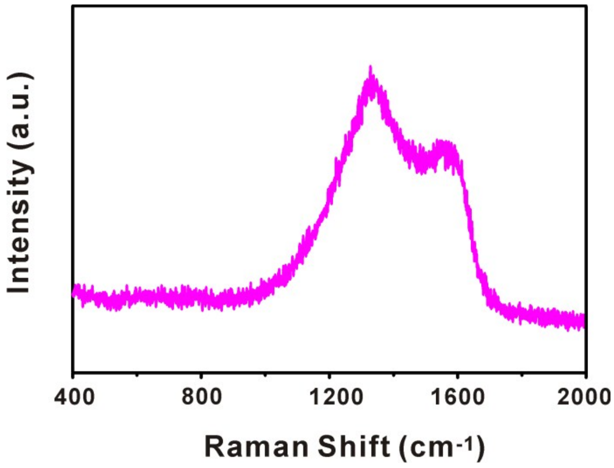

Fig. S3 Raman spectrum of carbon foam with pyrolysis temperatures at 700 ^{o}C.

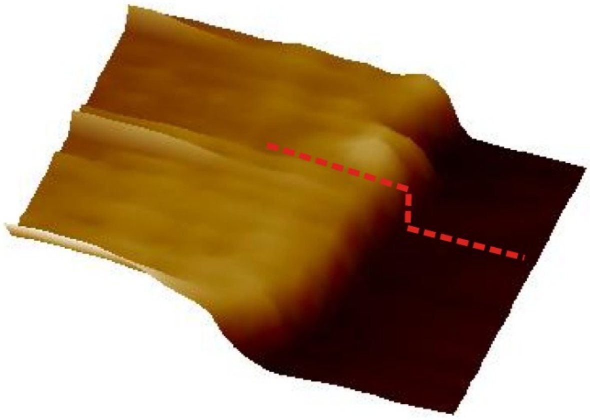

Fig. S4 AFM image of ZnO NMs with 200 ALD cycles with thickness of ~36 nm.

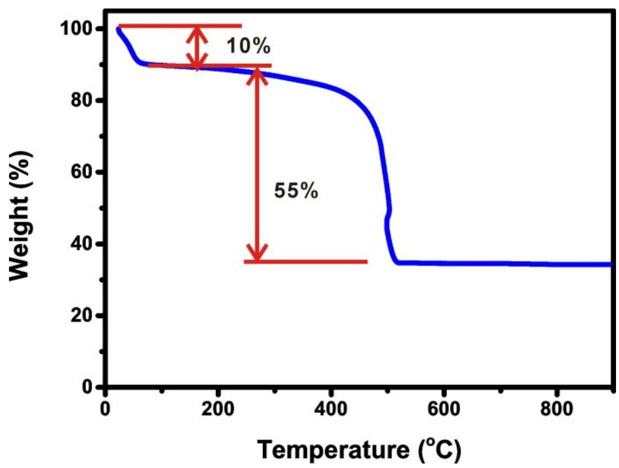

Fig. S5 TGA of C/ZnONMs foam.

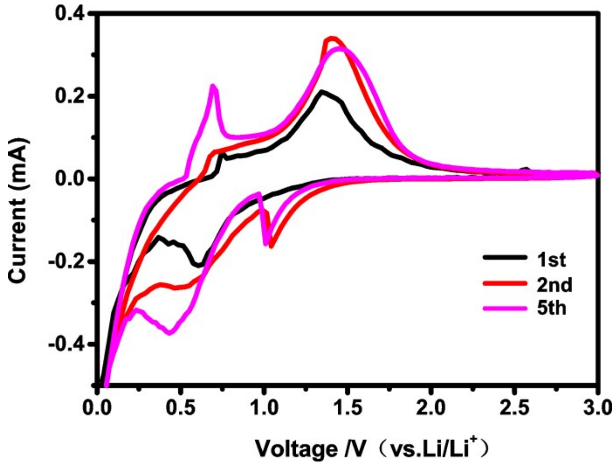

Fig. S6 CV curves of ZnO NMs electrode in the potential window of 0-3V with a scanning rate at 0.2 mV s^{-1}.

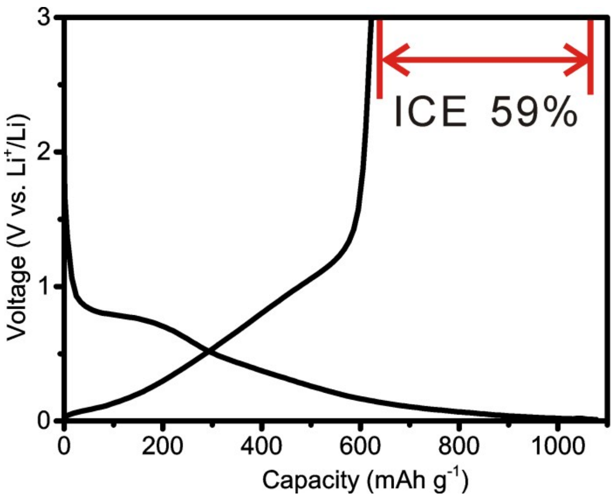

Fig. S7 First galvanostatic charge/discharge profile at 80 mA g^{-1}.

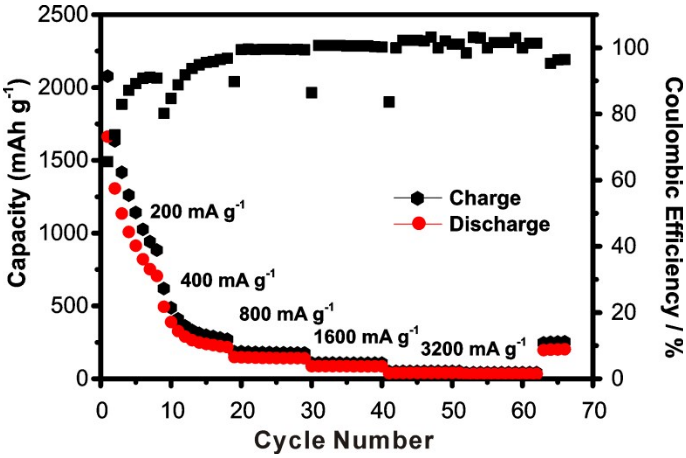

Fig. S8 Electrochemical performance of pure ZnO NMs.

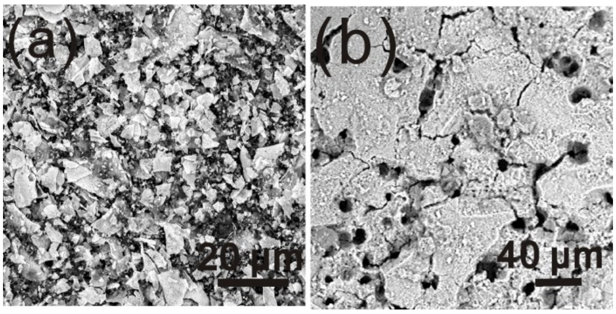

Fig. S9 SEM images of ZnO NMs electrode (a) before and (b) after 100 cycles.

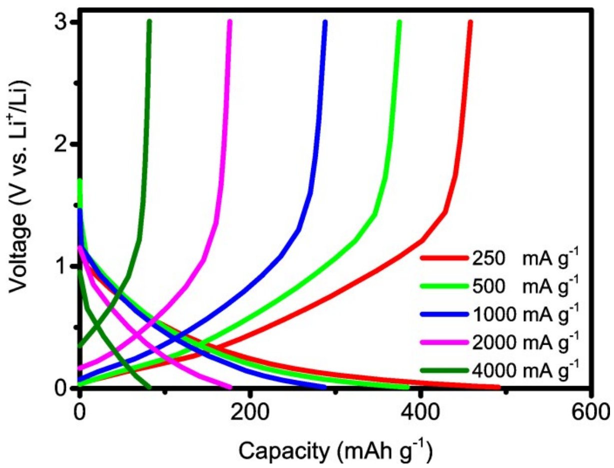

Fig. S10 Galvanostatic charge/discharge profiles of C/ZnO NMs foam electrode at 250, 500, 1000, 2000 and 4000 mA g^{-1}. The data are extracted from the second cycle at each current density.

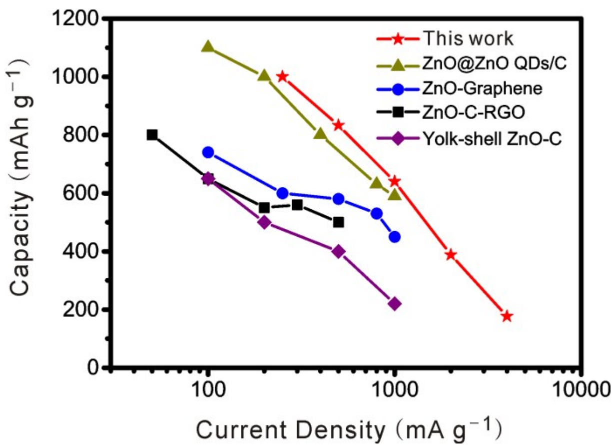

Fig. S11 Comparison of rate performance of C/ZnO NMs foam electrode with those of C/ZnO composites reported in recent publications (see below). The capacities are calculated based on the mass of ZnO.

The values in the figure are extracted from following publications (from top to bottom):

1 G. H. Zhang, S. C. Hou, H. Zhang, W. Zeng, F. L. Yan, C. C. Li and H. G. Duan, *Adv. Mater.*, 2015, **27**, 2400-2405.

2 M. P. Yu, A. J. Wang, Y. S. Wang, C. Li and G. Q. Shi, *Nanoscale*, 2014, **6**, 11419-11424.

3 Shilpa, B. M. basavaraja and S. B. Majumder. *J. Mater. Chem. A*, 2015, **3**, 5344-5351.

4 Q. S. Xie, X. Q. Zhang, X. B. Wu, H. Y. Wu, X. Liu, G. H. Yue, Y. Yang and D. L. Peng, *Electrochimica Acta*, 2014, **125**, 659-665.

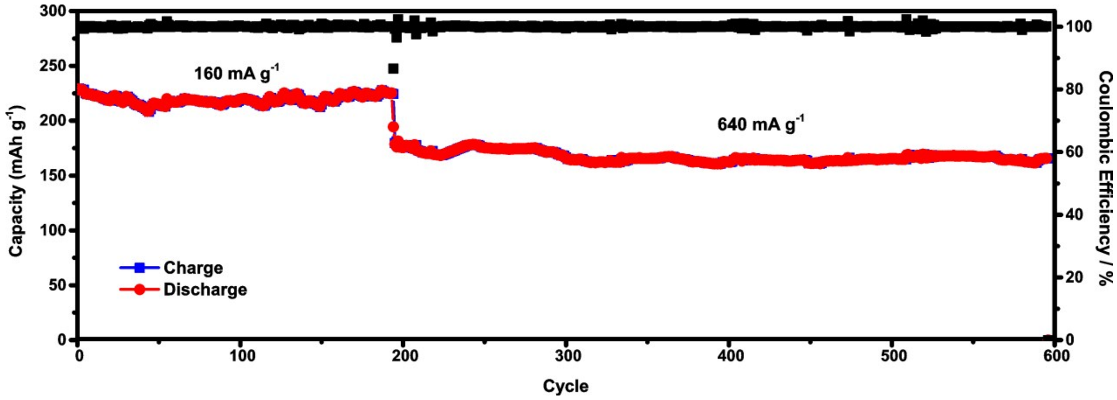

Fig. S12 Cycling performance of carbon foam pyrolyzed at 700 °C at 160 and 640 mA g^{-1}.

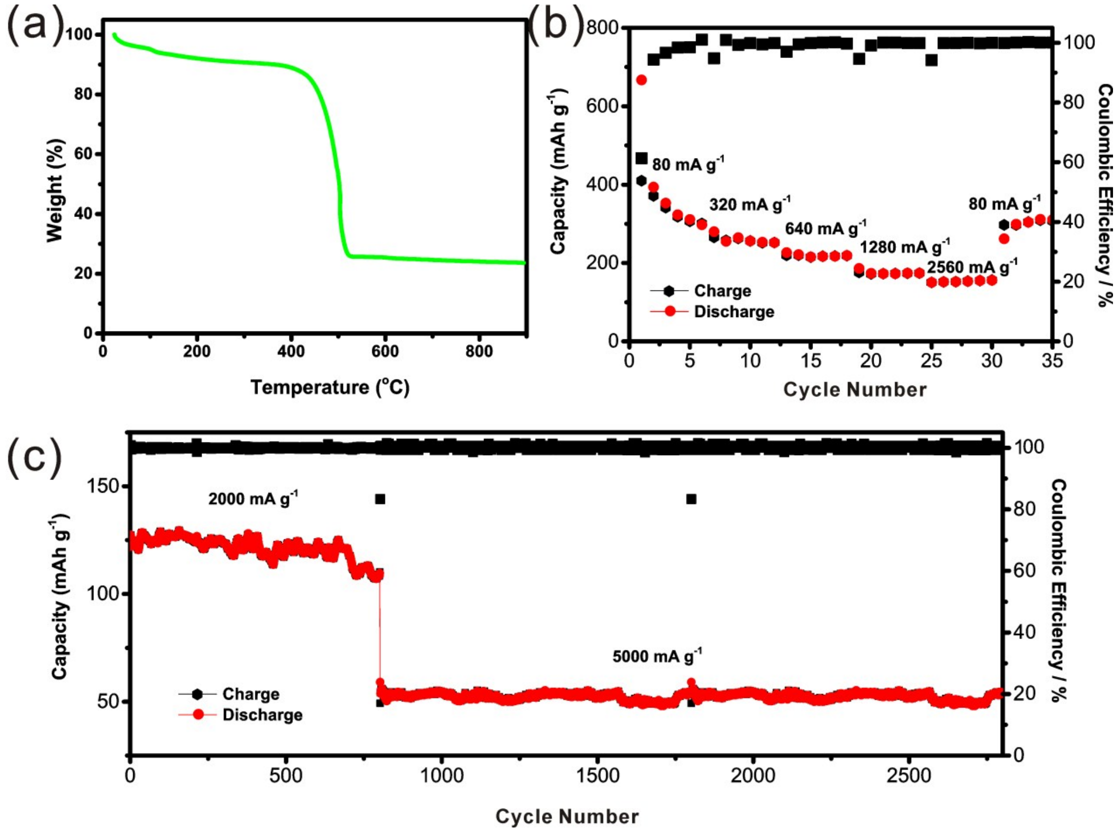

Fig S13. (a) TGA of C/ZnO NMs foam with 23% ZnO. The rate (b) and (c) cycling performance of the corresponding electrode. All capacities are calculated by the mass of electrode.

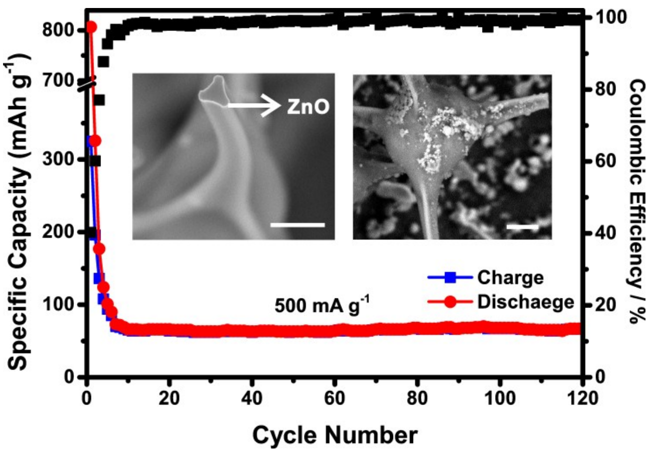

Fig. S14 Cycling performance at 500 mA g^{-1} of electrode made by directly depositing ZnO NM on carbon foam with 200 ALD cycles. The insets are the SEM images of the structure before (left) and after (right) cycling. Scale bar: 3 μm.

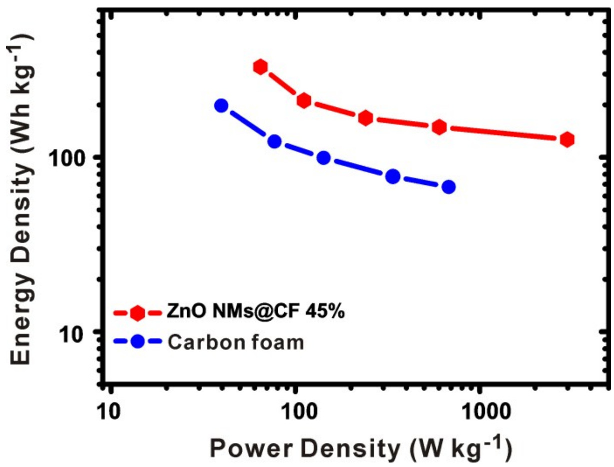

Fig. S15 Ragone plot of energy and power densities of C/ZnO NMs foam composite and pure carbon foam. Calculations are based on the masse of the electrode.

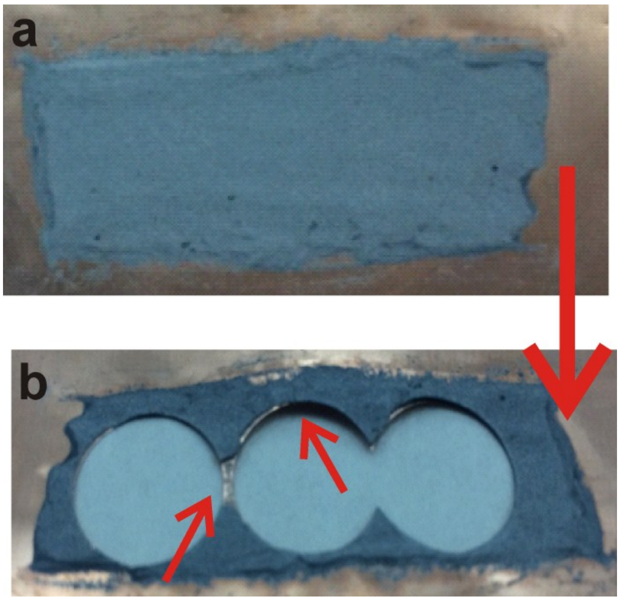

Fig. S16 The conventional ZnO NMs electrode with areal capacity at around 4 mAh cm^{-2} prepared by typical slurry coating method onto flat metallic current collect. (a) The thickness is close to 500 μm. (b) The thick dry slurry easily detaches from current collector.