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

Supporting Information

Rapid and facile synthesis of hierarchically mesoporous TiO_2-B with enhanced reversible capacity and rate capability

Yubin Liu,[a, b] Minghuang Guo,[a, b] Zhenwei Liu,[a, b] Qiaohua Wei [b] and Mingdeng Wei*[a, b]

[a] State Key Laboratory of Photocatalysis on Energy and Environment, Fuzhou University, Fuzhou, Fujian 350116, China

[b] Institute of Advanced Energy Materials, Fuzhou University, Fuzhou, Fujian 350116, China

* Corresponding author. E-mail: wei-mingdeng@fzu.edu.cn

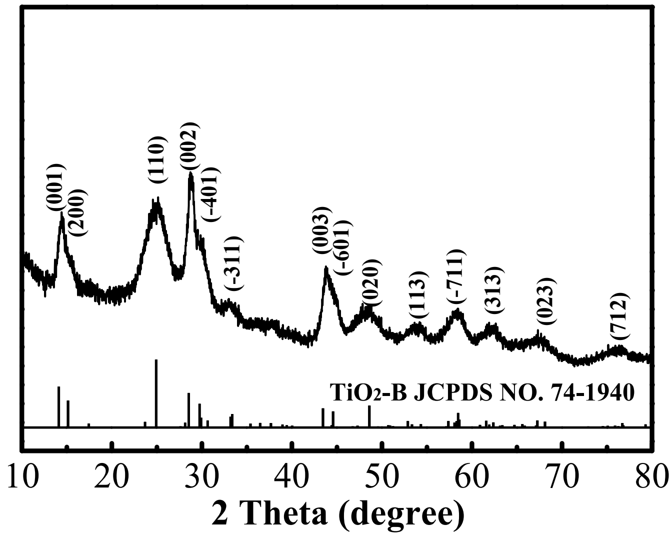

Fig. S1 XRD patterns of TiO_2-B/amorphous carbon.

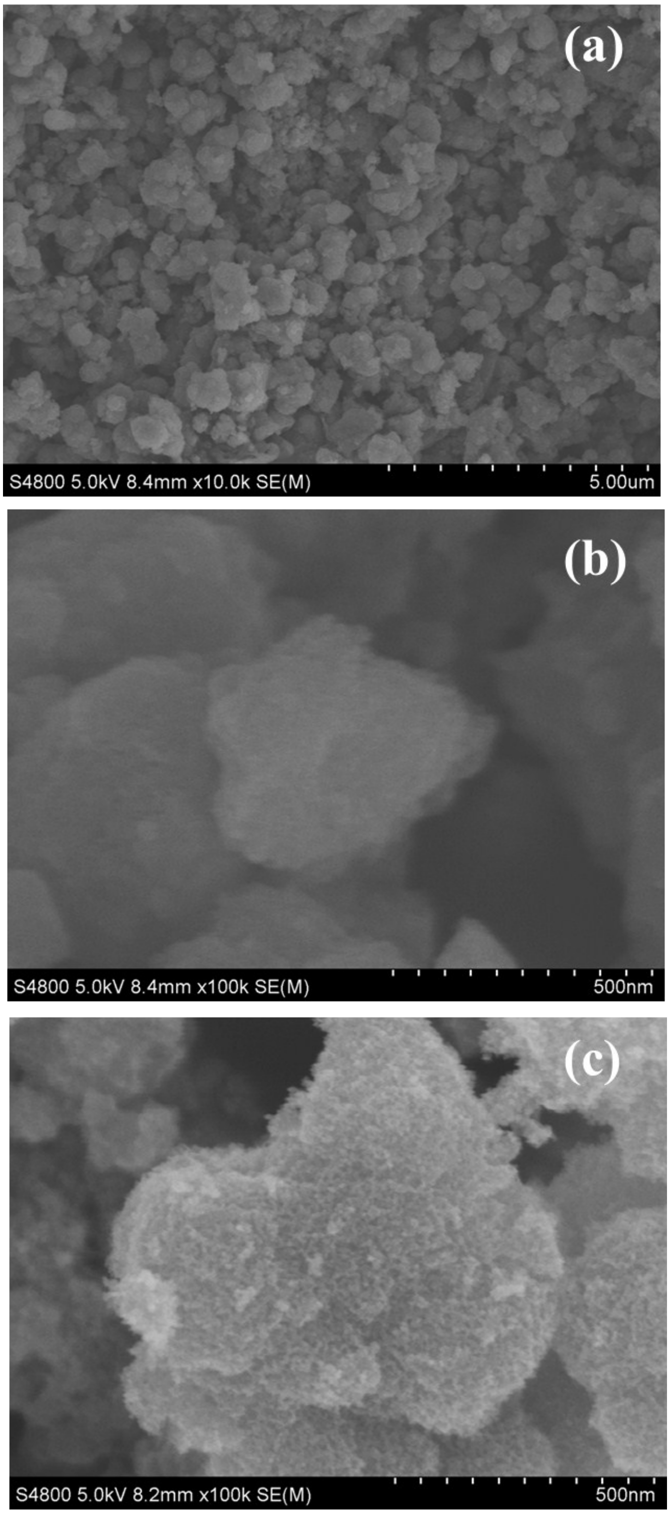

Fig. S2 (a-b) SEM images of TiO_2-B/amorphous carbon and (c) SEM image of HMTOB.

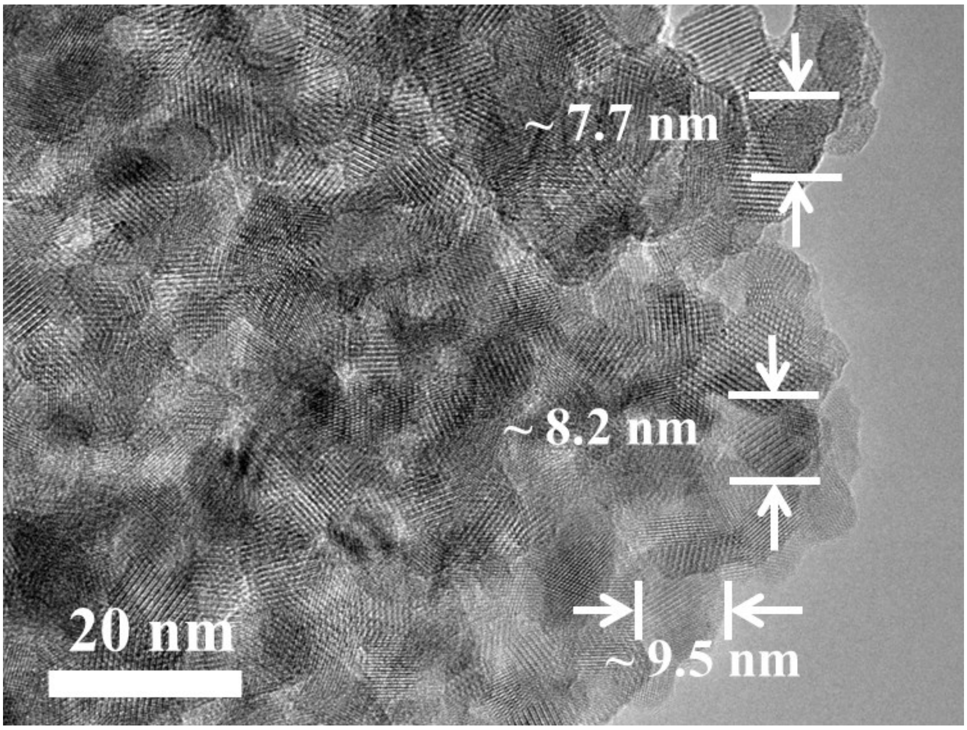

Fig. S3 TEM images of TOB.

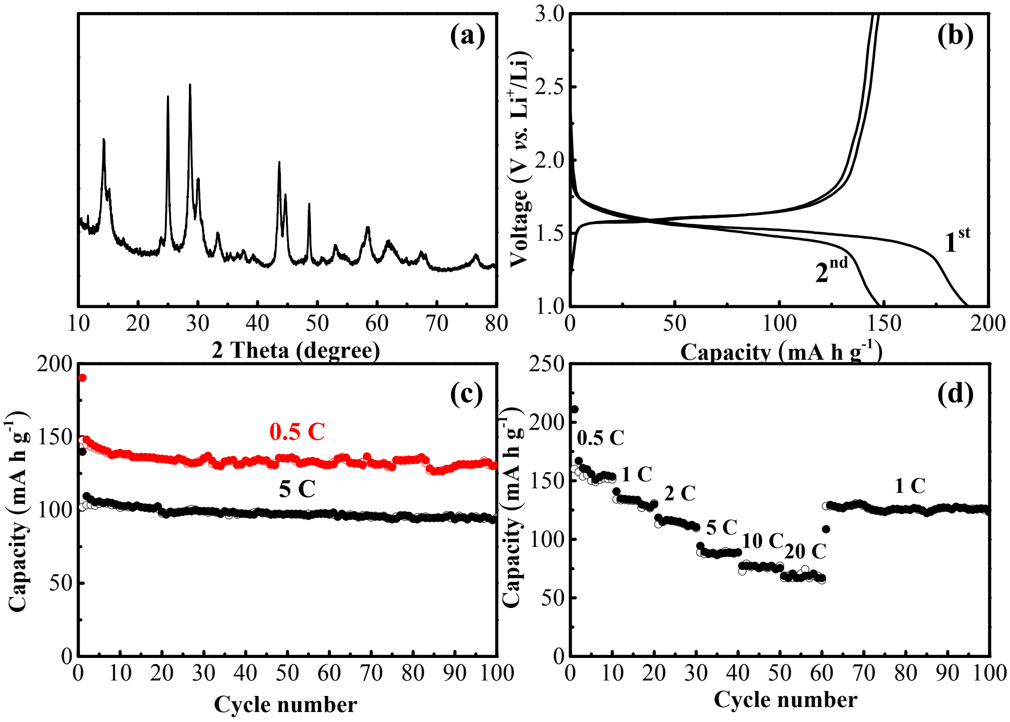

Fig. S4 (a) XRD pattern, (b) discharge-charge profiles, (c) cycling performances and (d) rate capability of bulk TiO_2-B.

Bulk TiO_2-B was obtained as the following: 1.0 g of anatase TiO_2 was mixed with 0.65 g KNO_3. This powder was transferred to a ceramic boat and heated to 1000 ^oC in air for 6 h to form $K_2Ti_4O_9$. Excess 0.1 M HNO_3 was added to the solid and stirred vigorously for 3 days. The solid was harvested via centrifugation, washed thoroughly with deionized water for several times, and then dried in an oven at 70 ^oC overnight. The resulting sample was calcined at 500 ^oC in air for 2 h with a heating rate of 2 ^oC min^{-1} and bulk TiO_2-B was obtained.

As shown in Fig. S4a, all the diffraction peaks of bulk TiO_2-B can be indexed to pure TiO_2-B. Fig. S4b shows discharge-charge profiles of bulk TiO_2-B at a current density of 0.5 C. As shown in Fig. S4b, bulk TiO_2-B showed a capacity of 130.6 mA h g^{-1} after 100 cycles at a current density of 0.5 C, which was much lower than that of HMTOB. When the current density was increased to 5 C, a capacity of 93.6 mA h g^{-1} was observed after 100 cycles. On the other hand, bulk TiO_2-B exhibited inferior rate capability. Capacities of 153.5, 129.8, 110.5, 88.8, 75.4 and 67.0 mA h g^{-1} were observed at current densities of 0.5, 1, 2, 5, 10 and 20 C, respectively.

Table 1 Summary of hydrothermal or solvothermal time and rate capability for various TiO_2-B as an anode for LIBs.

TiO_2-B	Hydrothermal or solvothermal time (hour)	Discharge capacity (mA h g^{-1})	Rate	Reference
Mesoporous TiO_2–B microspheres	72	165 130	10 C 30 C	1
TiO_2-B nanowires	24	168 140	~ 3 C ~ 6 C	2
Nanosheet-constructed porous TiO_2–B	24	202	10 C	3
Mesoporous TiO_2-B microflowers	5	205	10 C	4
TiO_2-B nanosheets	4	196	10 C	5
TiO_2-B hierarchical tubes	24	160 130	10 C 20 C	6
TiO_2-B nanoparticles	22	128 100	5 C 10 C	7
hierarchically mesoporous TiO_2-B	2	181.3 174.6	10 C 20 C	This work

References

1 H. S. Liu, Z. H. Bi, X. G. Sun, R. R. Unocic, M. P. Paranthaman, S. Dai and G. M. Brown, *Adv. Mater.*, 2011, **23**, 3450.
2 J. M. Li, W. Wan, H. H. Zhou, J. J. Li and D. S. Xu, *Chem. Commun.*, 2011, **47**, 3439-3441.
3 S. H. Liu, H. P. Jia, L. Han, J. L. Wang, P. F. Gao, D. D. Xu, J. Yang and S. N. Che, *Adv. Mater.*, 2012, **24**, 3201-3204.
4 V. Etacheri, Y. T. Kuo, A. Van der Ven and B. M. Bartlett, *J. Mater. Chem. A*, 2013, **1**, 12028-12032.
5 H. Huang, Z. Y. Yu, W. J. Zhu, Y. P. Gan, Y. Xia, X. Y. Tao and W. K. Zhang, *J. Phys. Chem. Solids*, 2014, **75**, 619-623.
6 H. Hu, L. Yu, X. H. Gao, Z. Lin and X. W. Lou, *Energ. Environ. Sci.*, 2015, **8**, 1480-1483.
7 C. Wessel, L. A. Zhao, S. Urban, R. Ostermann, I. Djerdj, B. M. Smarsly, L. Q. Chen, Y. S. Hu and S. Sallard, *Chem. Eur. J.*, 2011, **17**, 775-779.