

## Supporting Information

### **Hydrothermal Synthesis of TiO<sub>2</sub>(B) Nanowires with Ultrahigh Surface Area and Their Fast Charging and Discharging Properties in Li-ion Battery**

Jianming Li, Wang Wan, Henghui Zhou\*, Jingjian Li, and Dongsheng Xu\*

*Beijing National Laboratory for Molecular Sciences, State Key Laboratory for Structural  
Chemistry of Unstable and Stable Species, College of Chemistry and Molecular Engineering,  
Peking University, Beijing 100871, P.R. China*

E-mail: dsxu@pku.edu.cn; hhzhou@pku.edu.cn

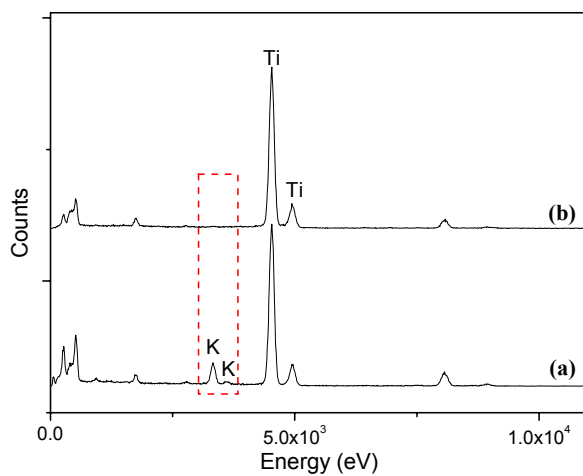
### ***Experimental Section***

**Synthesis of TiO<sub>2</sub>(B)-t nanowires:** Potassium titanate nanowires (K-TNWs) were prepared by hydrothermal reaction of P25 in KOH solution. Typically, P25 (2g) was dispersed in KOH solution (80mL, 10M) and placed into a 100mL Teflon-lined autoclave. The autoclave was heated at 200°C for 24 h, after naturally cooled to room temperature, the produced white precipitates were isolated from solution by centrifugation and subsequently washed with deionized water and ion-exchange in 0.1M nitric acid solution for several times. The obtained proton exchanged titanate nanowires (H/K-TNWs) were washed with deionized water to pH 7 of the solution and then dried at 60°C in vacuum for 10 h. The TiO<sub>2</sub>(B)-t nanowires (t denotes the hydrothermal temperature) were prepared by adding H/K-TNWs (0.3 g) in nitric acid solution (40 mL, 0.1M) and placed into a 50 mL Teflon-lined autoclave. The autoclave was heated at the designed temperature (120, 150 and 180°C) for 24 h. After naturally cooled to room temperature, the obtained white TiO<sub>2</sub>(B) precipitations were isolated from solution by centrifugation and subsequently washed with deionized water and then dried at 60°C in vacuum for 10 h.

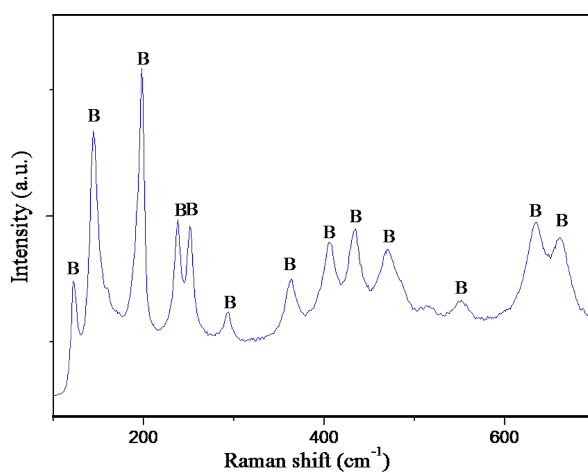
**Synthesis of TiO<sub>2</sub>(B)-c nanowires:** Sodium titanate nanowires (Na-TNWs) were prepared by reacting P25 (2g) with NaOH (10M) at 200°C for 24h, after naturally cooled to room temperature, the produced white precipitates were isolated from solution by centrifugation and subsequently washed with deionized water and ion-exchange in 0.01M nitric acid solution for several times. The obtained proton exchanged titanate nanowires H-TNWs were washed with deionized water to pH 7 of the solution and then dried at 60°C in vacuum for 10 h. The TiO<sub>2</sub>(B)-c nanowires were prepared by heating the H-TNWs at 450°C for 3 h in air.

**Materials Characterization:** The morphologies and the structures of the samples were characterized by scanning electron microscopy (SEM, S4800), Energy dispersive X-ray spectroscopy (EDS), transmission electron microscopy (TEM) and high-resolution TEM (HRTEM, FEI Tecnai F30, 300 kV), X-ray powder diffraction (XRD, Rigaku D/max-2500 diffractometer with  $\text{CuK}\alpha$  radiation,  $\lambda=0.1542$ , 40 kV, 100 mA), Raman spectra of was measured on a Renishaw Invia MicroRaman Spectrometer III-001, the excitation source was He-Ne laser (633 nm), and BET (Micrometrics ASAP 2010).

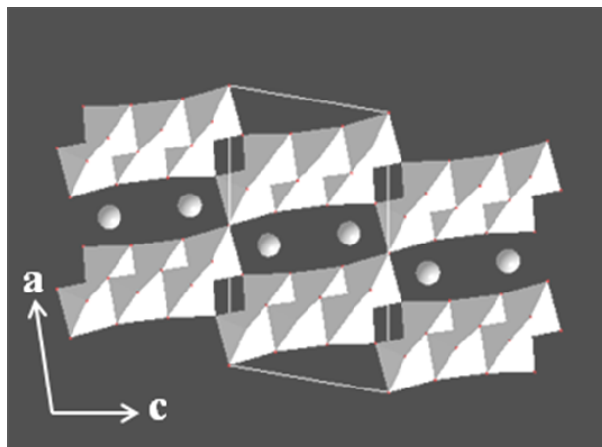
**Electrochemical measurement:** Lithium sheet was used as counter electrodes, composite materials comprising active mass (73 wt.%), carbonaceous additive (acetylene black, 15 wt.%) and poly(vinylidene difluoride) (PVDF, 12 wt.%) binder were used as the working electrode, and 1M  $\text{LiPF}_6$  solution in a 1:1 (volume) mixture of ethylene carbonate (EC) and dimethyl carbonate (DMC) was used as electrolyte. The galvanostatic cycling was measured on a LAND cell test (Land-CT 2001C) system at a constant at the designed current density in the voltage range from 1.0V to 3.0V versus  $\text{Li/Li}^+$ .



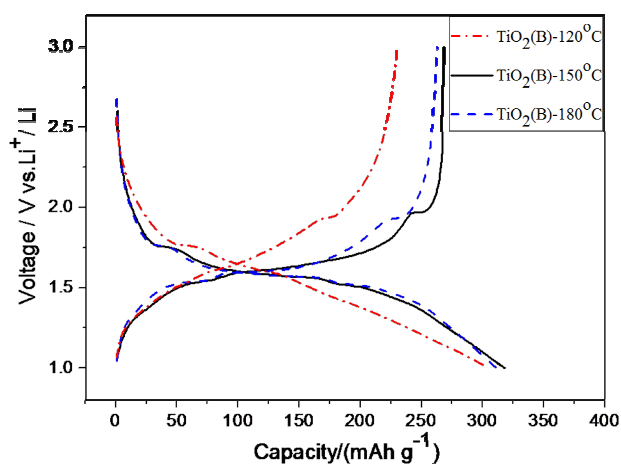
**Figure S1.** Energy dispersive X-ray spectroscopy (EDX) of potassium to titanium (a) H/K-TNWs and (b)  $\text{TiO}_2(\text{B})$  nanowires. Red dash rectangular indicates the energy position of potassium.



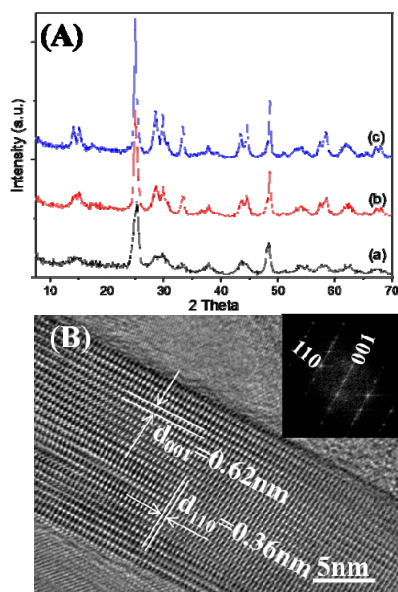
**Figure S2.** Raman spectra of  $\text{TiO}_2(\text{B})$  nanowires.



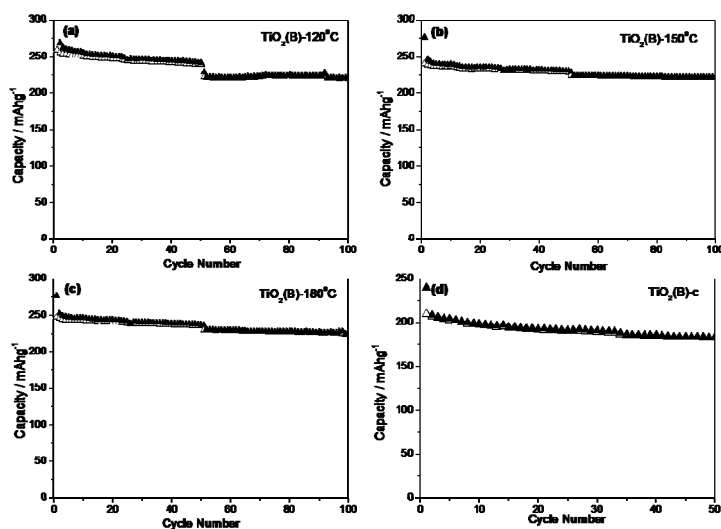
**Figure S3.** Crystal structures of H/K-TNWs viewing from [010] direction.



**Figure S4.** Variation of potential (versus a 1 M  $\text{Li}^+ / \text{Li}$  electrode) with charge passed for  $\text{TiO}_2(\text{B})$ -t nanowires at  $10 \text{ mA g}^{-1}$ .



**Figure S5** (A) X-ray diffraction patterns of calcinated TiO<sub>2</sub>(B)-t nanowires (a) TiO<sub>2</sub>(B)-120, (b) TiO<sub>2</sub>(B)-150 and (c) TiO<sub>2</sub>(B)-180; (B) HRTEM image of a single calcinated TiO<sub>2</sub>(B) nanowire. The phase, crystal structure and orientation of TiO<sub>2</sub>(B) were not changing.



**Figure S6** Variation of discharge (▲) and charge (△) capacities versus cycle number for (a)-(c) calcinated TiO<sub>2</sub>(B)-t nanowires cycled at 10 mA g<sup>-1</sup> and 50 mA g<sup>-1</sup> (50 cycles for each rate); (d) TiO<sub>2</sub>(B)-c nanowires cycled at 50 mA g<sup>-1</sup> between voltage limits of 1.0 and 3.0 V.