Supporting Information

Design and synthesis of interconnected hierarchically porous anatase titanium dioxide nanofibers as high-rate and long-cycle-life anodes for lithium-ion batteries

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KEYWORDS: TiO_2, Anatase, Lithium-ion batteries, Porous structures, Nanofibers, Anodes

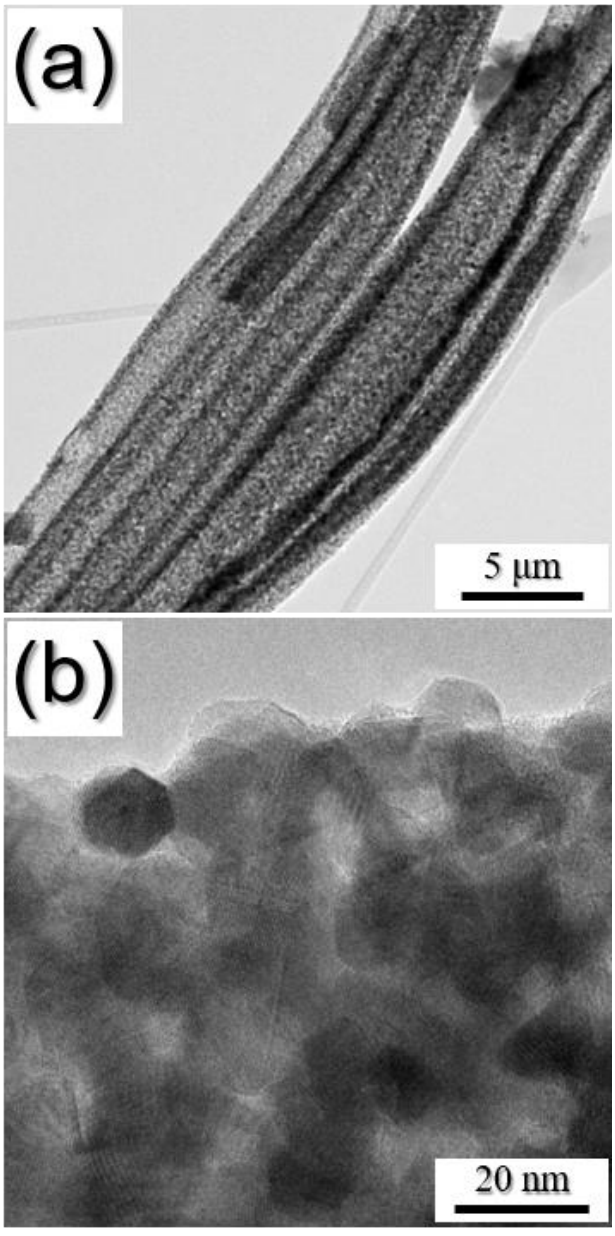

Fig. S1. (a, b) HR-TEM images of the TiO_2 nanofiber with tube-like structure.

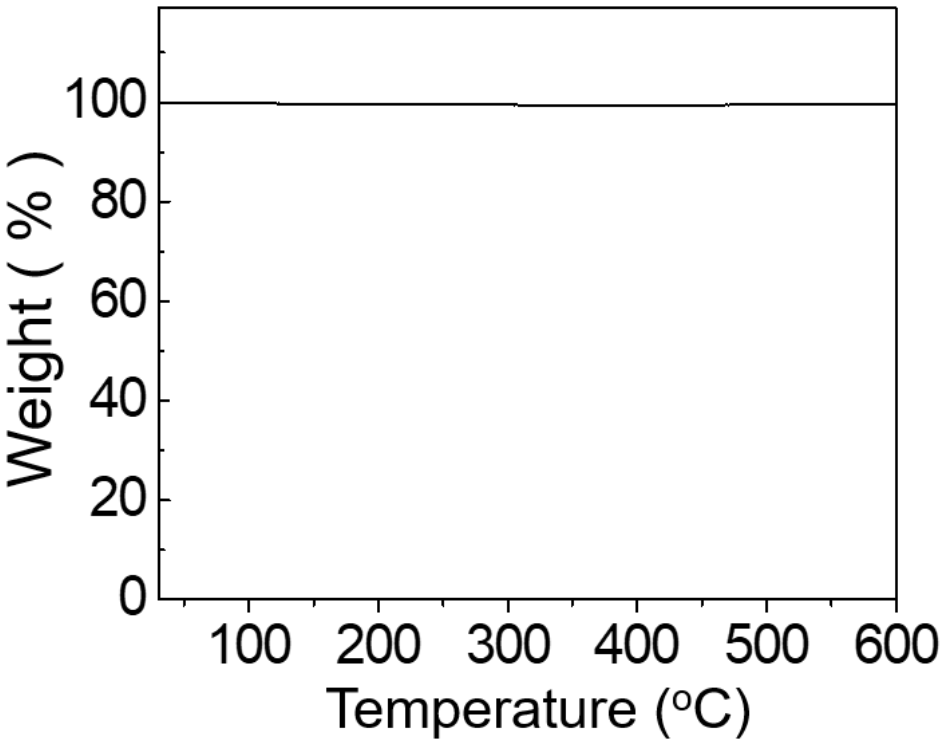

Fig. S2. TGA curve of IHP-A-TiO_2 nanofibers obtained after heat-treatment of PS dispersed PAN/TBT composited nanofibers at 500 °C.

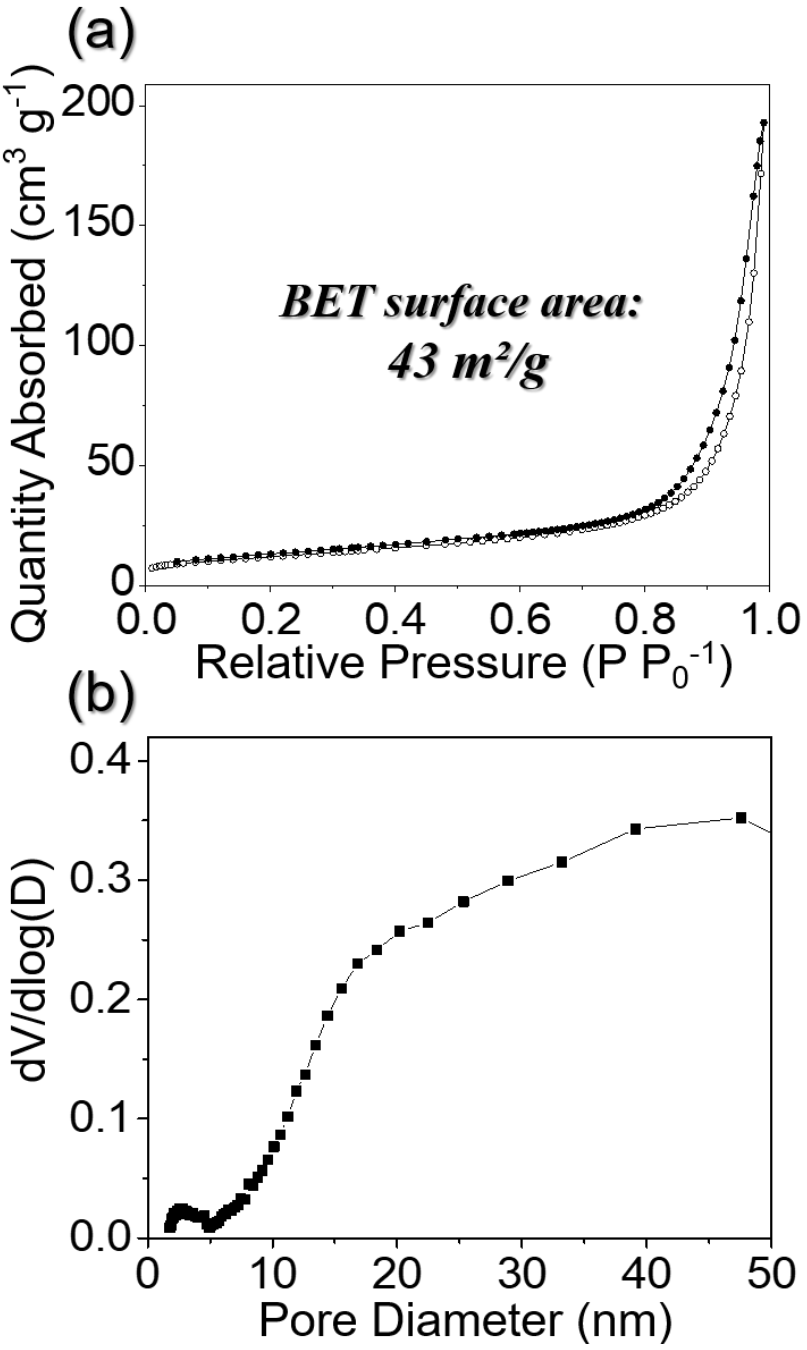

Fig. S3. (a) N_2 adsorption and desorption isotherms and (b) BJH pore size distributions of IHP-A-TiO_2 nanofibers.

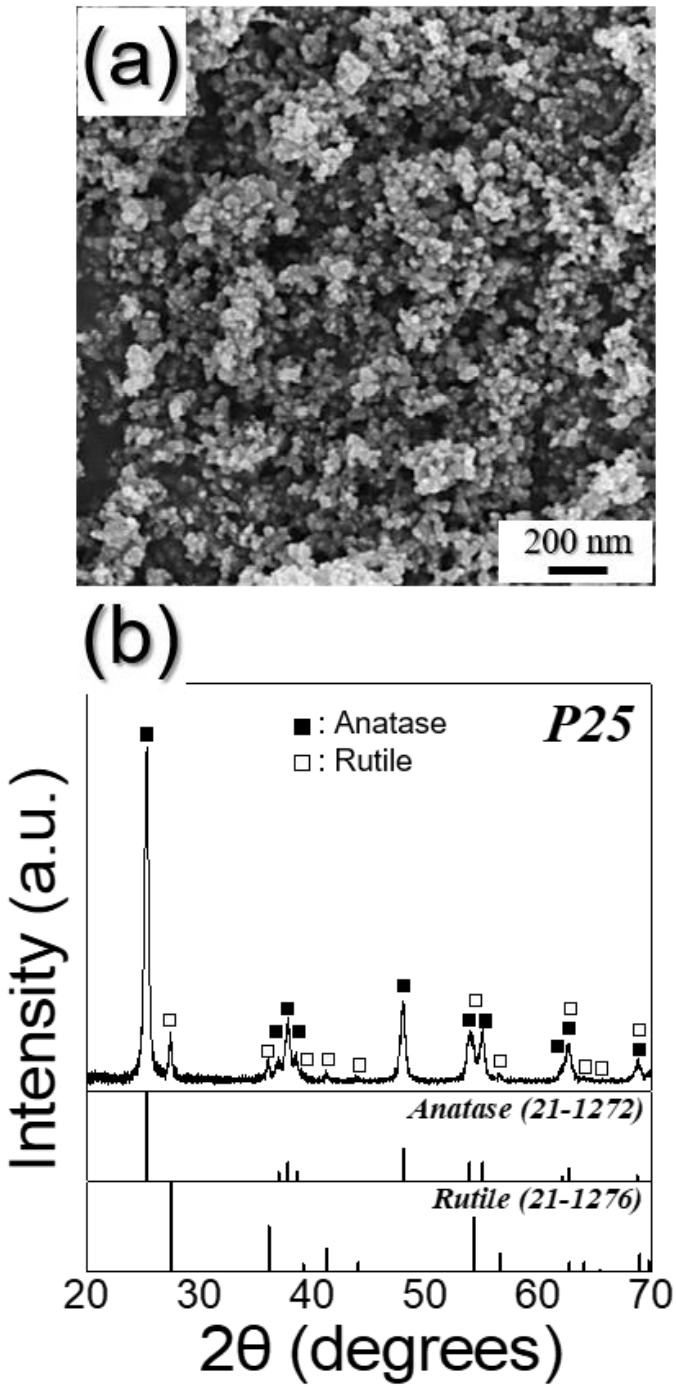

Fig. S4. (a) FE-SEM image and (b) XRD pattern of the commercial TiO_2 nanopowders (P25).

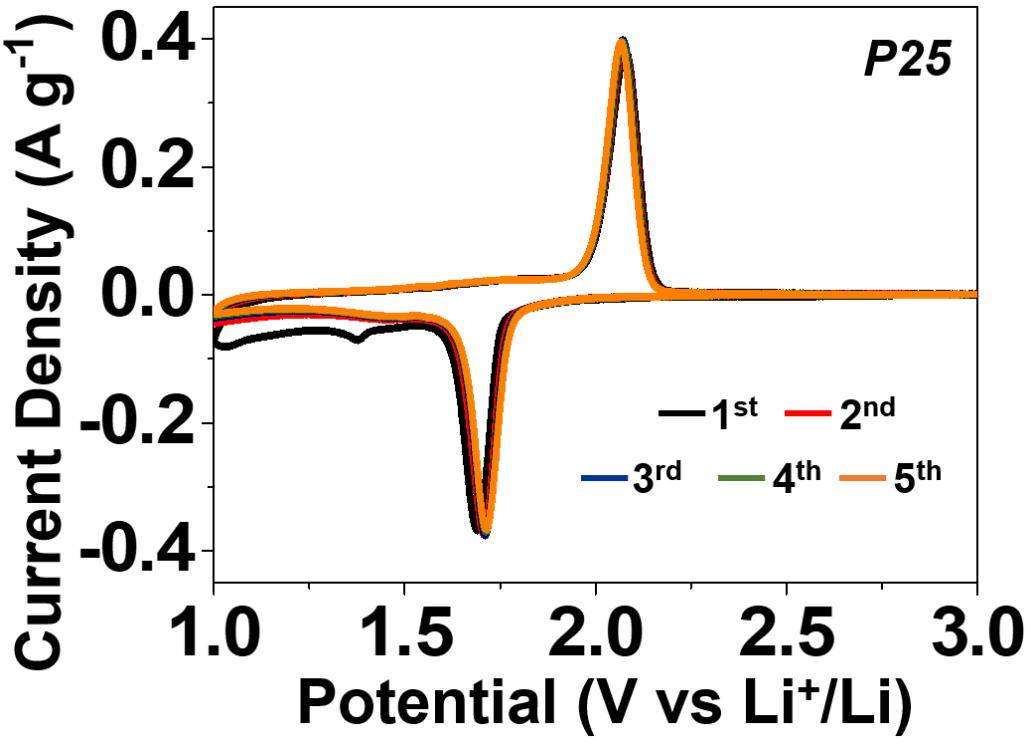

Fig. S5. CV curves of the commercial TiO_2 nanopowders (P25).

Table S1. Comparison of the electrochemical performances of various TiO_2 anatase structures for lithium-ion batteries.

Materials	**Voltage range (V)**	**Current rate**	**Initial C_{dis}/C_{cha} [mA h g^{-1}]**	**Discharge capacity [mA h g^{-1}]**	**Cycle number**	**Ref**
IHP-A-TiO_2 nanofibers	1-3	1000 mA g^{-1}	178/143	142	**3000**	In this work
TiO_2 nanofibers with fiber-in-tube	1-3	200 mA g^{-1}	231/170	177	1000	[29]
Mesoporous anatase with an rrdered 3D pore structure	1-3	1500 mA g^{-1}	-	~140	500	[S1]
Porous anatase TiO_2	1-3	840 mA g^{-1}	-	106.5	500	[53]
Hierarchical porous anatase TiO_2	1-3	840 mA g^{-1}	-	~145	200	[S2]
Hierarchically structured porous TiO_2 spheres	1-3	178 mA g^{-1}	187/-	178	100	[63]
TiO_2 mesoporous microspheres	1-3	204 mA g^{-1}	156/-	150	50	[S3]
Mesoporous anataseTiO_2	1-3	1680 mA g^{-1}	126/123	122	1100	[S4]
Hierarchical anatase TiO_2 film	1-3	1680 mA g^{-1}	-	~120	400	[S5]
Hierarchical anatase TiO_2 spheres	1-3	850 mA g^{-1}	-	130	200	[S6]
Ultrathin Anatase TiO_2 Nanosheets	1-3	850 mA g^{-1}	204/169	136	100	[S7]
Anatase TiO_2 hollow nanofibers.	1-3	100 mA g^{-1}	184/150	~130	300	[S8]
Anatase TiO_2 nanosheet	1-3	1675 mA g^{-1}	-	120.2	200	[S9]
Petal-likeTiO2 nanosheets	1-3	400 mA g^{-1}	194/-	~180	50	[S10]
Porous anatase TiO_2 nanorods	1-3	120 mA g^{-1}	-	150	30	[S11]
multishelled TiO_2 hollow microspheres	1-3	1675 mA g^{-1}	-	119	1200	[S12]
Anatase TiO2 nanowires	1-3	200 mA g^{-1}	198/-	~158	20	[S13]
Porous anatase TiO_2 single crystal architectures	1-3	200 mA g^{-1}	156.1/155.8	114	100	[S14]

[S1] Y. Ren, L. J. Hardwick and P. G. Bruce, *Angew. Chem.*, 2010, **122**, 2624-2628.

[S2] Z. Xiu, M. H. Alfaruqi, J. Gim, J. Song, S. Kim, T. V. Thi, P. T. Duong, J. P. Baboo, V. Mathew and J. Kim, *Chem. Commun.*, 2015, **51**, 12274-12277.

[S3] J. Wang, Y. Zhou, Y. Hu, R. O'Hayre and Z. Shao, *J. Phys. Chem. C*, 2011, **115**, 2529-2536.

[S4] Z. Xiu, M. H. Alfaruqi, J. Gim, J. Song, S. Kim, P. T. Duong, J. P. Baboo, V. Mathew and J. Kim, *J. Alloy. Compd.*, 2016, **674**, 174-178.

[S5] B. Zhao and Z. Shao, *J. Phys. Chem. C*, 2012, **116**, 17440-17447.

[S6] H. B. Wu, X. W. D. Lou and H. H. Hng, *Chem. – Eur. J*, 2012, **18**, 2094-2099.

[S7] J. S. Chen, Y. L. Tan, C. M. Li, Y. L. Cheah, D. Luan, S. Madhavi, F. Y. C. Boey, L. A. Archer and X. W. Lou, *J. Am. Chem. Soc.*, 2010, **132**, 6124-6130.

[S8] X. Zhang, V. Aravindan, P. S. Kumar, H. Liu, J. Sundaramurthy, S. Ramakrishna and S. Madhavi, *Nanoscale*, 2013, **5**, 5973-5980.

[S9] J. S. Chen and X. W. Lou, *Electrochem.Commun.*, 2009, **11**, 2332-2335.

[S10] F. Wu, Z. Wang, X. Li and H. Guo, *Ceram. Int.*, 2014, **40**, 16805-16810.

[S11] S.-J. Bao, Q.-L. Bao, C.-M. Li and Z.-L. Dong, *Electrochem. Commun.*, 2007, **9**, 1233-1238.

[S12] H. Ren, R. Yu, J. Wang, Q. Jin, M. Yang, D. Mao, D. Kisailus, H. Zhao and D. Wang, *Nano Lett.*, 2014, **14**, 6679-6684.

[S13] F. Wu, X. Li, Z. Wang, H. Guo, L. Wu, X. Xiong and X. Wang, *J. Alloy. Compd.*, 2011, **509**, 3711-3715.

[S14] D. Zhang, M. Wen, P. Zhang, J. Zhu, G. Li and H. Li, *Langmuir*, 2012, **28**, 4543-4547.