Preferential Growth of $Li_4Ti_5O_{12}$ onto (020) Planes of TiO_2(B) Towards Highly Reversible and Durable TiO_2-Based Li-Ion Battery Anode

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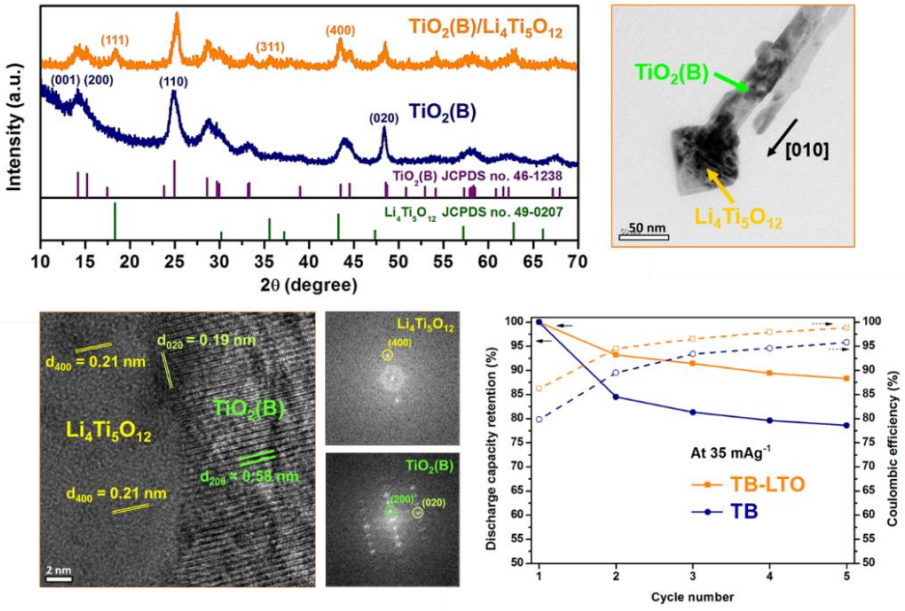
Abstract

The synthesis of anatase TiO_2-free TiO_2(B)/$Li_4Ti_5O_{12}$ composite remains unexploited due to the co-occurrence of anatase TiO_2 and $Li_4Ti_5O_{12}$ both derived from TiO_2(B) during conventional synthesis. Here, TiO_2(B)/$Li_4Ti_5O_{12}$ dumbbell-like nanofibers (TB-LTO) comprising $Li_4Ti_5O_{12}$ nanocrystals preferentially grown onto (020) planes of TiO_2(B) nanofibers are synthesized via a simple hydrothermal approach using pristine TiO_2(B) nanofibers (TB) and LiOH solution as precursors. The preferential growth is originated from the high surface free energy of (020) plane relieved by the coverage of $Li_4Ti_5O_{12}$ with a relatively small lattice mismatch, serving as the key to the successful preparation of TB-LTO with negligible anatase TiO_2 content. Benefiting from the synergistic effect of the composition and structure containing new TiO_2(B)/$Li_4Ti_5O_{12}$ interfaces, the TB-LTO dumbbell-like nanofiber features a significantly mitigated initial ICL (7 % at 35 mA g^{-1}), stable cycling (93 % capacity retention after 1000 cycles at 1750 mA g^{-1}), and enhanced rate performance (122 mAh g^{-1} at 2630 mA g^{-1}). This work reveals a potentially effective way to integrate $Li_4Ti_5O_{12}$ with mestastable phases like TiO_2(B) for high electrochemical performance and durability.



Acknowledgement: The authors acknowledge financial support from Innovation and Technology Fund (ITS/378/13), Internship Programme (InP/299/14) and HKU Seed Fund for Basic Research (201605159011)