

Preferential Growth of $\text{Li}_4\text{Ti}_5\text{O}_{12}$ onto (020) Planes of $\text{TiO}_2(\text{B})$ Towards Highly Reversible and Durable TiO_2 -Based Li-Ion Battery Anode

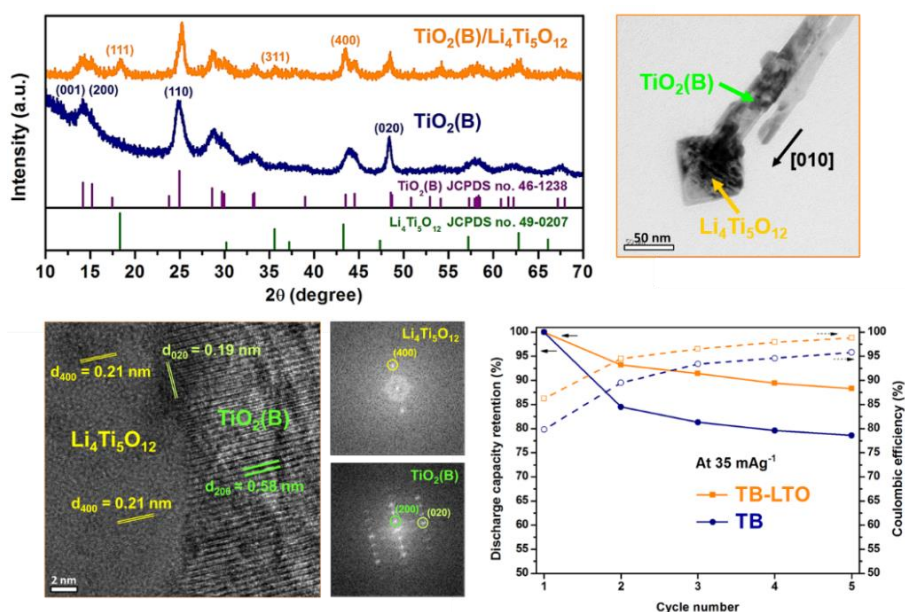
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Abstract

The synthesis of anatase TiO_2 -free $\text{TiO}_2(\text{B})/\text{Li}_4\text{Ti}_5\text{O}_{12}$ composite remains unexploited due to the co-occurrence of anatase TiO_2 and $\text{Li}_4\text{Ti}_5\text{O}_{12}$ both derived from $\text{TiO}_2(\text{B})$ during conventional synthesis. Here, $\text{TiO}_2(\text{B})/\text{Li}_4\text{Ti}_5\text{O}_{12}$ dumbbell-like nanofibers (TB-LTO) comprising $\text{Li}_4\text{Ti}_5\text{O}_{12}$ nanocrystals preferentially grown onto (020) planes of $\text{TiO}_2(\text{B})$ nanofibers are synthesized via a simple hydrothermal approach using pristine $\text{TiO}_2(\text{B})$ 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 $\text{Li}_4\text{Ti}_5\text{O}_{12}$ 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 $\text{TiO}_2(\text{B})/\text{Li}_4\text{Ti}_5\text{O}_{12}$ 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 $\text{Li}_4\text{Ti}_5\text{O}_{12}$ with metastable phases like $\text{TiO}_2(\text{B})$ for high electrochemical performance and durability.



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