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Improvement on electrochemical performances of nanoporous titania as anode of lithium-ion batteries through annealing of pure titanium foils

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Abstract: The effect of annealing of Ti foils before anodization on the morphology and electrochemical performance of resultant nanoporous anatase TiO₂ (np-TiO₂) as anode in rechargeable lithium-ion batteries (LIBs) was investigated. The np-TiO₂ anode fabricated from annealed Ti foils exhibited higher specific surface area and reduced pore diameter compared to np-TiO₂ electrode fabricated from as-received Ti foils. The highly porous np-TiO₂ anode fabricated from annealed Ti foils exhibited 1st discharge capacity of 453.25 mAh/g and reduced to 172.70 mAh/g at 1 C current rate after 300 cycles; whilst the np-TiO₂ electrode fabricated from the as-received Ti foils exhibited 1st discharge capacity of 213.30 mAh/g and reduced to 160.0 mAh/g at 1 C current rate after 300 cycles. Even after 400 cycles, such np-TiO₂ electrode exhibited a reversible capacity of 125.0 mAh/g at 2.5 C current rate. Compared to the untreated Ti foils, the enhanced electrochemical performance of np-TiO₂ anode fabricated from annealed Ti foils was ascribed to the annealing-induced removal of residual stress among the Ti atoms. The benefit of annealing process can reduce pore size of as-fabricated np-TiO₂.

Keywords: Annealing; Nanoporous; Anatase; Titanium oxide; Anode; Lithium-ion battery

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