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Anatase TiO_2 Nanostructures with Enhanced Surface Activity for High-Performance Lithium-Ion Batteries

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Abstract : Amorphous colloidal TiO_2 spheres were annealed at high temperatures to yield anatase-phase TiO_2 nanoparticles. With a specific discharge capacity of around 296 mAh g^{-1} (0.1C), the annealed TiO_2 outperformed its amorphous counterpart, which produced about 182 mAh g^{-1} at the same rate. The annealed material's larger surface area and more active sites are responsible for this improvement. The amorphous TiO_2 nanoparticles, on the other hand, produced a solid electrolyte interface (SEI) layer that contained organic phosphates, lithium carbonate, and lithium alkyl carbonates. This led to a decrease in performance and increased intrinsic resistance. By successfully removing surface hydroxyl groups and chemisorbed water, high-temperature annealing reduced capacity loss and improved structural and electrochemical stability. After prolonged cycling, the annealed TiO_2 demonstrated enhanced rate capability and cycling performance, retaining 93.5% of its capacity as opposed to 42.1% for the amorphous material. By shedding light on the function of surface chemistry and material processing in maximizing battery performance, our results show the potential of annealed anatase TiO_2 as a high-performance electrode material for Li-ion batteries.

Keywords : TiO_2 li-ion battery, electrode, capacity, stability
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