Nanostructured Lithium Titanate ($Li_4Ti_5O_{12}$) Produced by Controlled Aqueous Synthesis and Thermal Transformation: Processing, Characterization and Electrochemical Performance

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Spinel $Li_4Ti_5O_{12}$ (LTO) draws significant attention as the anode material of choice for lithium ion batteries (LIBs) due to its superior characteristics (1). Firstly, its higher operational voltage (1.55 V Li^+/Li) can prevent the formation of the solid-electrolyte interphase (SEI) layer that usually reacts below 1.0 V Li^+/Li. Secondly, spinel LTO is a "zero-strain" electrode material, which leads to excellent reversibility and long service life. These advantages make LTO highly suitable for LIBs in applications, which require long cycle life, high safety and high power capability.

Recently, it was reported that the low electrical conductivity of LTO is significantly overcome by nanostructuring that can optimize interparticle contacting in building a continuous electronic network (2, 3). Nanostructured LTO can also provide higher capacity than its theoretical value because of surface charge accommodation (4). To synthesize nanostrucutred LTO in a more efficient and cost-competitive way, a new green synthesis route has been developed (5). The new process comprises (i) aqueous reactive precipitation involving LiOH and $TiCl_4$, (ii) conversion of the precipitate to lithium titanium hydrate via aging treatment at T<100 °C, and thermal transformation of the latter to LTO. Via this process, LTO nanoflower structured material can be prepared after annealing at as low as 400 ^oC. For optimum performance ensuring excellent capacity retention over long cycle life (6), it is necessary to promote crystallinity, while avoiding particle coarsening and aggregation.

The aim of the present communication is to report on the processing parameters that control the crystallinity, nanostructure and purity of prepared LTO and relate its material properties to performance via extensive electrochemical characterization.

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