

Supplementary Information

Experimental Details

100 mg of lithium (ABRC) were dissolved in an argon filled glovebox (water and oxygen level <1ppm) in 40 mL of benzyl alcohol (anhydrous, Sigma Aldrich) and stirred overnight at 50°C. 5 mL of stock solution were transferred each in a 10 mL teflon sealed microwave reaction vessels (CEM, Switzerland) and 665 µl of titanium (IV) isopropoxide (>99.999%, Sigma Aldrich) was added, resulting in a stoichiometric precursor solution. The mixture was heated at to 260 °C under constant stirring in a CEM Discover SP for 4 hours. The resulting white precipitation was collected by centrifugation and washed three times with ethanol and dimethylether. The powder was dried at 80 °C for 1h under vacuum. Afterwards the dried powder was weighed. The reported molar yield was calculated based on the average of 10 syntheses. To obtain highly crystalline samples, calcination at 750°C for 1 hour under air is required. Electrochemical data were collected using a Biologic (VMP 3) potentiostat. The XRD images (Figure S1) show that while increasing the lithium concentration in the precursor solution removes the anatase impurities, it results instead in Li₂TiO₃ impurities that are not electrochemically active. Reducing the lithium concentration further, increased the anatase content.

Calculation of Energy Savings of Microwave Synthesis

A comparable reaction using an autoclave heated in a conventional oven for 48 hours at 250 °C and an one hour annealing step at 750 °C requires an oven such as the Apex30 (250 °C Apex range Fanned convection laboratory ovens, Carbolite), with 30 L volume. Heating this oven to 250 °C requires 23 min at 1000 Watts, and, holding the temperature at 250 °C, requires an additional 320 Watts.

In contrast, our microwave requires 250 Watts for 4 min for heating and 150 Watts for 4 hours for the reaction. The final annealing step requires as well 750 °C for one hour. Our precursor mixture in the vessel size of 10 mL is one quarter of the autoclave size.

Autoclave: Energy needed = 1000 W * 23 min + 320W * 2880 min = 1,38 MJ + 55.3 MJ = 56.68 MJ

Microwave: Energy needed = 250 W * 4min + 150 Watt * 240 min = 0.06 MJ + 2.16 MJ = 2.22 MJ

→ 2.22 MJ *4 = 8.88 MJ for four vessels ~15.6 % of the energy needed for the autoclave reaction.

Electrochemical Analysis of Materials prior to Calcination

The voltage profiles of the as-prepared samples from the microwave have strong slopes, confirming a high amount of TiO₂ impurities (Fig. S1). The material exhibits low capacity of about 70 mAhg⁻¹, but does show good cycling stability (92.5 % of the initial capacity was preserved after 200 cycles).

High Coulombic efficiencies of over 99% are obtained (Figure S3)

Particle Size Distribution

The particle size distribution of the calcined microspheres indicates a bimodal distribution, with 50% of the particles below 6.36 µm and an SMD of 4.39 µm (Figure S4). The measurements were done together with Sympatec, Germany. The samples were dispersed with a RODOS system at 3.02 bar and the particle size was determined using a HELOS sensor.

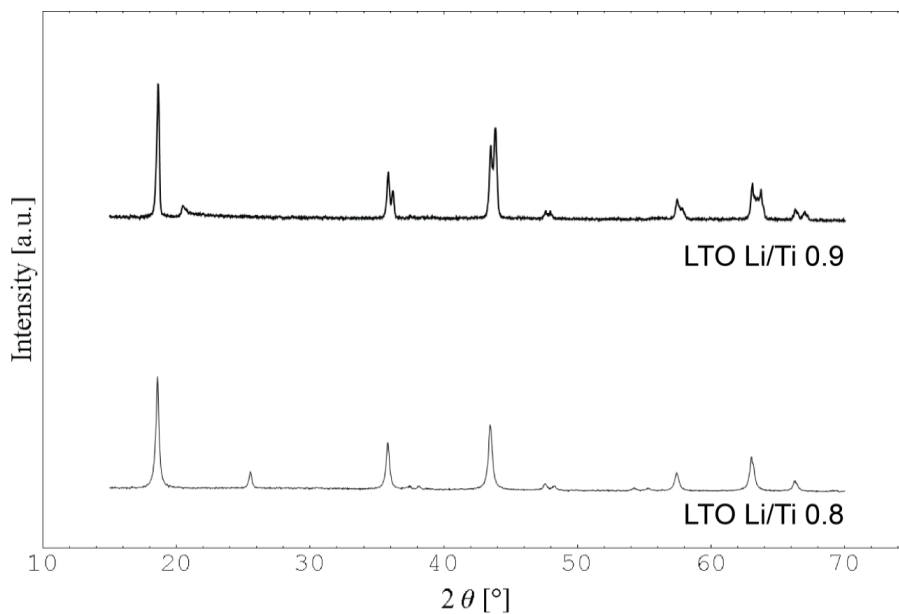


Figure S1 XRD data of powders obtained by a stoichiometric LTO precursor solution (Li/Ti ratio 0.8) with minor anatase impurities and by a lithium rich precursor solution (Li/Ti 0.9) with about 15% Li_2TiO_3 impurities. Li_2TiO_3 has the same crystallographic lattice parameters, but different axis length. Therefore they appear as double peaks.

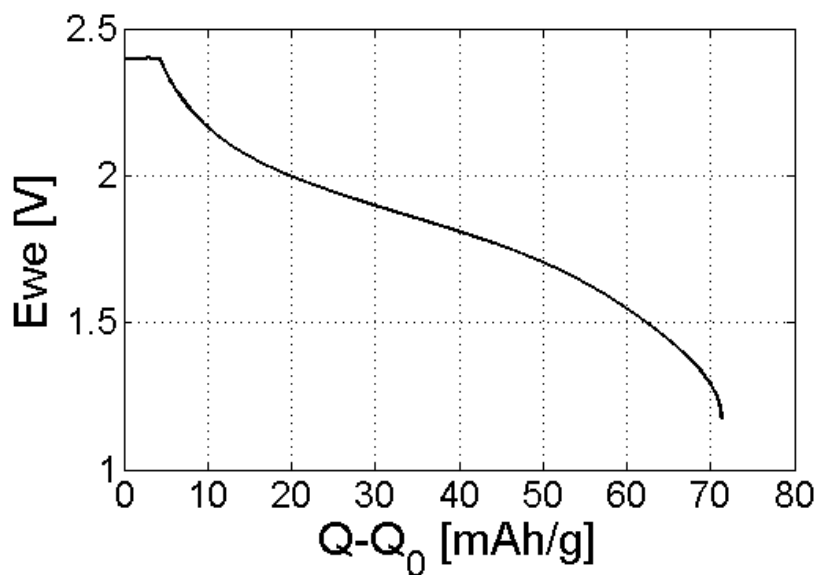


Figure S2 Discharge curve of the as prepared nanoplatelet material. An annealing step at 750 °C for one hour improved the performance significantly.

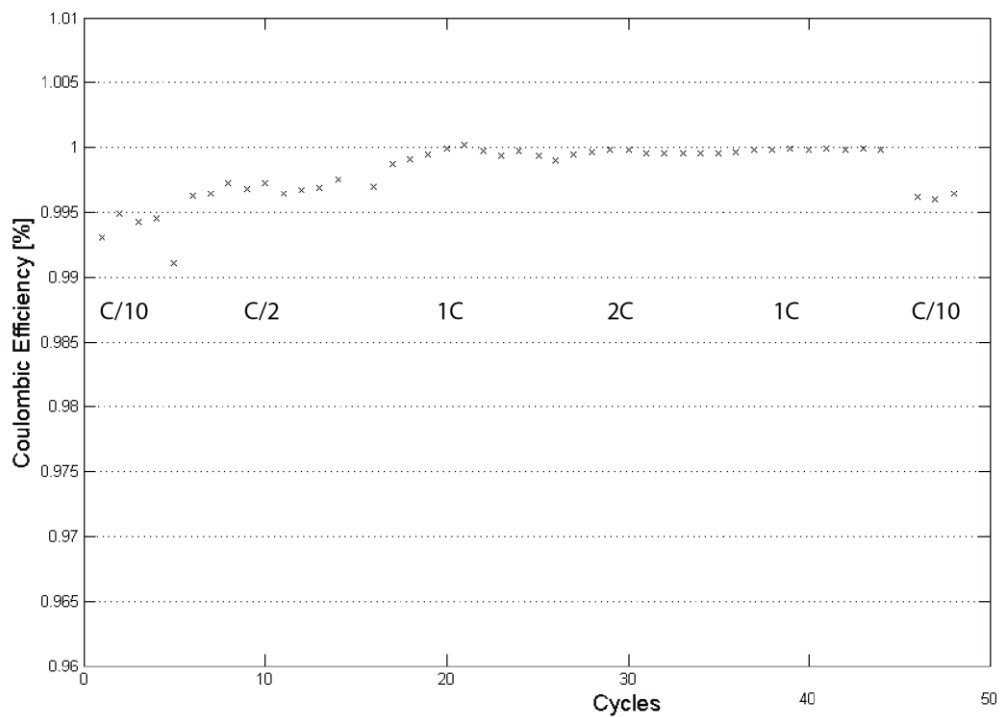


Figure S3 Coulombic Efficiencies of the calcined LTO microspheres at different cycling rates.

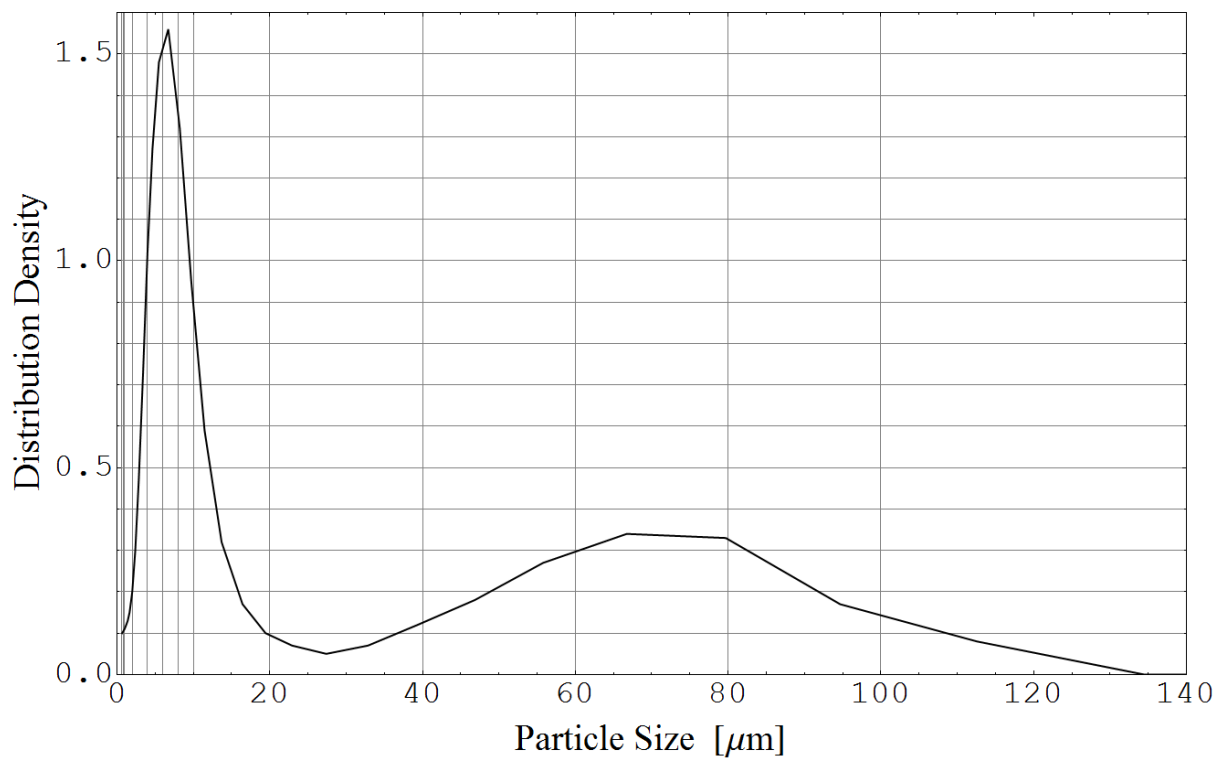


Figure S4 Particle size distribution of the calcined LTO microspheres.