Electronic Supplementary Information (ESI)

Synthesis of nano-Li$_4$Ti$_5$O$_{12}$ decorated on non-oxidized carbon nanotubes with enhanced rate capability for lithium-ion batteries

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Figure S1. Schematic illustration of the protocol adopted for the synthesis of nano-Li₄Ti₅O₁₂ decorated on non-oxidized CNTs.
Figure S2. Schematic diagram of the cell used for measuring the electrical conductivity of the samples by using the two-point probe method. The cell was assembled with a stainless-steel top electrode and a fixed bottom electrode, poly(methyl methacrylate) (PMMA) mould, and Li₄Ti₅O₁₂/CNTs nanocomposite electrode in the form of a pelletized disc of area 1.33 cm².
Figure S3. Raman spectrum of Li$_4$Ti$_5$O$_{12}$ in Li$_4$Ti$_5$O$_{12}$/CNTs nanocomposite. Seven vibrational peaks were observed at 233, 268, 356, 433, 628, 676, and 740 cm$^{-1}$. These Raman-allowed phonon peaks are the fingerprints of the spinel structure (A$_{1g}$+E$_{g}$+3F$_{2g}$+F$_{1u}$+F$_{2u}$), which confirm the formation of phase-pure spinel Li$_4$Ti$_5$O$_{12}$ in the nanocomposite.
Figure S4. (a) SEM and (b) TEM images of the Li$_4$Ti$_5$O$_{12}$ nanoparticles prepared by the microwave-solvothermal method in the absence of CNTs. The resulting Li$_4$Ti$_5$O$_{12}$ nanoparticles (size < 50 nm) were agglomerated because of the absence of the CNT matrix. (c) The second charge-discharge curves of Li$_4$Ti$_5$O$_{12}$ nanoparticles prepared in the absence of CNTs. Rate capability of Li$_4$Ti$_5$O$_{12}$ nanoparticles (mixed with 15 wt% CNT) under different current rates (from right to left): 1, 2, 5, 10, 20, and 30 C-rate.
Figure S5. Thermogravimetric analysis (TGA) of Li$_4$Ti$_5$O$_{12}$/CNT nanocomposite. From the thermogravimetric data, the loading amount of Li$_4$Ti$_5$O$_{12}$ in the Li$_4$Ti$_5$O$_{12}$/CNTs nanocomposite was evaluated to be 80 wt%.
Figure S6. Comparison of rate capabilities (discharge capacity versus discharge rate) of the Li$_4$Ti$_5$O$_{12}$/CNT nanocomposite prepared in this study with that of the reported Li$_4$Ti$_5$O$_{12}$/CNT composite (refs. 1, 2, 3, 4) and Li$_4$Ti$_5$O$_{12}$/graphene composite (refs. 5, 6, 7, 8, 9, 10, 11).
References


