

Size Controlled $\text{Li}_4\text{Ti}_5\text{O}_{12}$ Nanocrystals Synthesized in a Continuous Pulsed Flow Reactor

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Spinel $\text{Li}_4\text{Ti}_5\text{O}_{12}$ (LTO) is known as a zero strainanode material [1] for lithium batteries. It is also inherently safe due to the high equilibrium potential of the $\text{Ti}^{4+}/\text{Ti}^{3+}$ redox couple for Li ion insertion. LTO is a promising candidate in the application of electric vehicles (EV) and energy storage for solar or wind power plants. However, the poor electronic and ionic conductivity of LTO limit the application at higher rate capability. Among various strategies, nanosizing is an effective routine to overcome this drawback.

In this work, synthesis of nanocrystalline LTO is achieved via a novel continuous pulse flow hydrothermal reactor [2] by a one-step reaction. The crystalline nanoparticles are synthesized by mixing the reactants with solvent at near- and supercritical conditions. Phase pure $\text{Li}_4\text{Ti}_5\text{O}_{12}$ nanocrystals with tunable particle size from 3 ~ 20 nm can be easily prepared by adjusting the reaction temperature, pulse frequency, and solvent to reactant ratio. The size and crystallinity effect on the electrochemical performance is studied in a coin cell using lithium metal as the counter electrode.

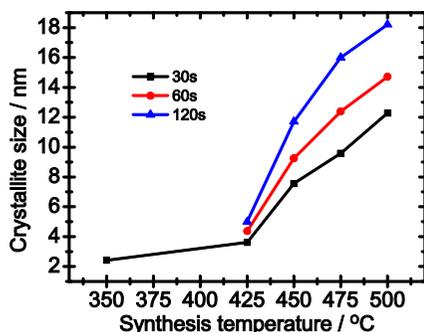


Figure 1. Crystallite size of the particles prepared at various temperatures and reaction times.

References

- [1] T. Ohzuku, et al, J. Electrochem. Soc. 1995, 142, 1431.
- [2] J. R. Eltzholtz, B. B. Iversen, Rev. Sci. Instrum. 2011, 82, 084102