Fabrication and Electrochemical Properties of $\text{Li}_4\text{Ti}_5\text{O}_{12}@\text{Li}_6\text{PS}_5\text{Cl}$ for All-solid-state Lithium Batteries using Simple Mechanical Method

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$\text{Li}_6\text{PS}_5\text{Cl}$ -coated $\text{Li}_4\text{Ti}_5\text{O}_{12}$ materials was fabricated by a simple liquid-phase treatment method. Charge-discharge tests show that $\text{Li}_6\text{PS}_5\text{Cl}$ -coated $\text{Li}_4\text{Ti}_5\text{O}_{12}$ (LTO@LPSCl)/ $\text{Li}_6\text{PS}_5\text{Cl}$ /Li all-solid-state lithium batteries exhibit high reversible capacity ($\sim 158 \text{ mA h g}^{-1}$) after 250 cycles under 0.05 C and excellent rate capacity ($\sim 50 \text{ mA h g}^{-1}$) under 1 C at 80 °C. A combination of scanning electron microscopy (SEM), energy dispersive X-ray analysis (EDX) mapping, and electrochemical impedance spectra (EIS) reveals that good wettability of liquid with $\text{Li}_4\text{Ti}_5\text{O}_{12}$ materials and $\text{Li}_6\text{PS}_5\text{Cl}$ is responsible for $\text{Li}_6\text{PS}_5\text{Cl}$ nanoparticle coated on the surface of $\text{Li}_4\text{Ti}_5\text{O}_{12}$ materials homogenously, which build the stable interface between active materials and solid state electrolyte, reduce the interface resistance effectively, and result in excellent electrochemical performances.

Keywords: all-solid-state lithium battery, electrode-electrolyte interface, 200#Paint solvent, $\text{Li}_4\text{Ti}_5\text{O}_{12}@\text{Li}_6\text{PS}_5\text{Cl}$ nanocomposites, liquid-phase method

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