# Rational Solvent Selection for $Li_7P_3S_{11}$-Based Cathode Slurry Processing toward Scalable All-Solid-State Battery Fabrication

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**Abstract:**
The development of scalable manufacturing routes is essential for translating sulfide-based all-solid-state batteries from laboratory-scale demonstrations to practical cell architectures. Among the key processing challenges, the preparation of cathode slurries containing sulfide solid electrolytes requires careful solvent selection because solvent–electrolyte interactions can alter the chemical structure and ionic transport properties of the solid electrolyte. Therefore, rational selection of processing solvents is critical for developing wet-processing strategies that maintain electrolyte integrity while remaining compatible with conventional electrode fabrication processes.In this study, a systematic solvent-selection strategy was developed for cathode slurry processing involving $Li_7P_3S_{11}$ (LPS) sulfide solid electrolyte. Trichloroethylene(TCE),Triethylamine (TEA) and Benzene were selected based on a combination of physicochemical and processing parameters, including polarity index, dipole moment, vapor pressure, boiling point and flash point. The compatibility of LPS with the selected solvents was investigated using FTIR, UV-Vis, Raman, and NMR spectroscopy, complemented by electrochemical characterization and density functional theory(DFT) calculations.The combined results indicated that the investigated solvents did not induce significant chemical degradation of LPS under the studied conditions. By integrating the physicochemical properties of the solvents with the observed solvent–electrolyte interactions, their potential suitability for LPS-based cathode slurry formulations was evaluated. These findings provide a rational basis for the preliminary screening of processing solvents and support further development of slurry formulation, electrode coating, and wet lamination strategies toward the scalable fabrication of all-solid-state pouch cells.