SUBLIME

Solid state sUlfide Based LI-MEtal batteries for EV applications

Deliverable 4.3 Report on formulation and process at lab scale

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Publishable summary

Deliverable D4.3. – Report on formulation and process at lab scale summarizes the activities regarding dry and wet chemical processing in WP4 of SUBLIME. For industrially relevant battery cells, sulfide electrolytes need to be processed to form thin (~30 µm) electrolyte sheets that are either directly applied to the electrodes as coatings or prepared as freestanding films. Furthermore, the fabrication of composite electrodes which also incorporate the solid electrolyte apart from the conventional components (active material, conducting additive, binder) poses a challenge for traditional manufacturing lines and novel processes need to be developed.

Thus, in a first step, processing methods for sulfide electrolyte powders developed in SUBLIME were investigated and their suitability to provide efficient electrolyte layers for all-solid-state batteries evaluated. Special focus was put on the selection of suitable binders and matching solvents and their impact on the mechanical and electrochemical properties of the resulting electrolyte films. Thus, 11 solvents and 6 binders were screened for their compatibility with the sulfide electrolytes and property maps could be established for the binder materials. Different approaches to balance the mechanical properties with the electrochemical performance were investigated and optimized recipes could be developed by blending different binder materials or selecting matching binder-solvent combinations. Additionally, different fabrication methods for composite cathodes were explored, namely wet-chemical processing, infiltration route, drop casting and dry processing. Wet chemical processing showed the most promising results in terms of scalability and key parameters for the composite cathodes like active material to electrolyte ratio, amount of conducting additive, binder etc. were optimized. Finally, several approaches for the preparation of cathode/electrolyte bilayers were investigated and evaluated for their suitability for large-scale production of all-solid-state batteries. Direct casting of the electrolyte onto composite cathode sheets has been found to be the most feasible fabrication method and yields acceptable electrochemical performance.