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Sodium-Ion and sodium Metal BAtteries for efficient and sustainable next-generation energy storage

GRANT AGREEMENT No. 963542

SIMBA – Deliverable Report

<< D4.4 – Incorporation of novel electrolyte >>

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Publishable summary

The main objective of the SIMBA project is to develop a highly cost-effective, safe, and all-solid-state battery using single-ion conducting polymer as electrolyte and sodium as a mobile charge carrier for large-scale stationary applications. Single-ion conducting polymer electrolytes (SIPEs) are a new class of solid-state electrolytes where the cation is the only mobile species. Depending on their formulations, they may offer an enhanced electrochemical stability window and good ionic conductivity at room temperature.

Deliverable 4.4 is associated with Task 4.6 (T4.6 - Incorporation of polymer electrolytes) of Work Package 4 (WP4). The activities of T4.6 consists of incorporating the SIPE developed in WP2, Task 2.3 (T2.3 - Develop stable single-ion conductor polymer electrolyte) into the anode and cathode electrode manufacturing anode/cathode – SIPE electrode composites. In addition, the liquid electrolyte of the baseline cells (see deliverable D4.1 – Baseline cell, electrochemical and physical characterization) is replaced by the all-solid-state SIPE membrane, and a direct electrochemical comparison is carried out within the liquid- and all-solid-state full-cells.

The D4.4 main objective is to evaluate the incorporation of SIPE into lab-scale cells and iteratively improve the electrochemical performance before developing 1 Ah all-solid-state pouch-cells. The all-solid-state sodium cells have been manufactured at the coin-cell level in KIT using optimized PW by Altris (T2.4), commercial hard carbon (the same as in the baseline cells), and a SIPE membrane developed at KIT (T2.3). Both cathode and anode electrodes were manufactured through an aqueous process in line with the SIMBA project. The optimum electrode formulation, which includes the SIPE, was investigated, using as a reference the one developed within T4.4.1 (Slurry formulation development for both anodes) and T4.5.1 (Slurry formulation development for both cathodes). Within the first 7 months of T4.6 (M18-M36), great progress has been made in SIPE-containing electrode processability and all-solid-state sodium cell manufacturing. The initial results reveal that the all-solid-state sodium cells deliver similar initial capacities as the baseline cells using the liquid electrolyte. However, the long-term stability should be improved, as well as some challenges need to be addressed. Therefore, the acquired knowledge and results at a lab-scale will be transferred to WMG and CEA for supporting the scale-up manufacturing of all-solid-state sodium demonstrators.

Appendix D – Disclaimer/Acknowledgement

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