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SIMBA – Deliverable Report

<< D4.8 – Proof-of-concept for solvent-free extrusion>>

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Checked by	Ivana Hasa (WMG)	2024-02-17
Reviewed by (if applicable)	Emma Kendrick (UBham)	2024-02-12
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Publishable summary

Battery manufacturing is a multi-step process starting from component manufacturing (cathode, anode, electrolyte separator) and going to final cell assembly and formation cycles. In order to further expand battery cell production and broaden their uses (electrical mobility, stationary storage, etc), it is now necessary to look at innovative processes that could reduce costs and energy consumption. One strategic path is to move from standard solvent casting to dry processing for component production.
Extrusion is considered as a possible process to progressively limit solvent handling and recycling in future battery manufacturing plants. Such methodology has been applied to SIMBA's innovative materials in order to develop proof-of-concept components of sodium-ion cells. Three extrusion methods were investigated and evaluated with Prussian White (PW) cathode material, Hard Carbon (HC) anode and a single-ion polymer electrolyte (NaPSiO).
For the electrolyte membrane, a direct extrusion with carbonate plasticizer was applied, as well as a standard high temperature melt extrusion followed by carbonate impregnation. Extrusion did not allow to reach in one single step the necessary carbonate content for electrochemical application (over 40 wt.%), but the obtained samples could be impregnated during a post-treatment step. As expected, the higher the carbonate content in the formulation, the higher the ionic conductivity.
Electrodes were also developed using solvent-based extrusion process, but stability issues between active materials and NaPSiO limited the final application in full cell. On the contrary, a water-based extrusion process was successfully applied at room temperature for both PW and HC, using lower water content than corresponding wet casting process. Formulations and operating conditions were optimized to achieve a roll-to-roll process. The obtained electrodes exhibited suitable characteristics for electrochemical evaluation in half and full cells. Despite having lower capacity than their wet-casted counterparts, PW extruded cathodes showed promising results. These preliminary results have paved the way to further application of extrusion process for the manufacturing of next-generation battery cells.

10 Appendix B - Acknowledgement

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Project partners:

#	Partner	Partner Full Name
1	TUDa	TECHNISCHE UNIVERSITAT DARMSTADT
2	UU	UPPSALA UNIVERSITET
3	UBham	THE UNIVERSITY OF BIRMINGHAM
4	WMG	THE UNIVERSITY OF WARWICK
5	KIT	KARLSRUHER INSTITUT FUER TECHNOLOGIE
6	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
7	IFE	INSTITUTT FOR ENERGITEKNIKK
8	SAS	USTAV ANORGANICKEJ CHEMIE SLOVENSKA AKADEMIA VIED (Institute of Inorganic Chemistry, Slovak Academy of Sciences)
9	FHG	FRAUNHOFER GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V.
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Appendix C – Disclaimer/Acknowledgement

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