

EUROPEAN COMMISSION

HORIZON 2020 PROGRAMME - TOPIC H2020-LC-BAT-2019
Strongly improved, highly performant and safe all solid-state batteries for
electric vehicles.

GRANT AGREEMENT No. 875189



SAFELiMOVE – Deliverable Report
D6.2 – Electrodes and separator strips manufacturing

Deliverable No.	SAFELiMOVE D6.2	
Related WP	WP6	
Deliverable Title	Electrodes and separator strips manufacturing	
Deliverable Date	2023.06.01	
Deliverable Type	Demonstrator	
Dissemination level	Confidential – member only (CO)	
Written By	Izaskun Combarro, Andriy Kvasha (CID), Amina Toudjine (Saft), Abdelbast Guerfi (HQ)	2023.06.01
Checked by	David Echasserieau (Saft)	2023.06.07
Reviewed by (if applicable)	Maria Martinez (CICe)	2023.06.28
Approved by	Maria Martinez (CICe)	2023.06.30
Status	Final	2023.06.30

Disclaimer / Acknowledgment



Copyright ©, all rights reserved. This document or any part thereof may not be made public or disclosed, copied or otherwise reproduced or used in any form or by any means, without prior permission in writing from the SAFELiMOVE Consortium. Neither the SAFELiMOVE Consortium nor any of its members, their officers, employees or agents shall be liable or responsible, in negligence or otherwise, for any loss, damage or expense whatever sustained by any person as a result of the use, in any manner or form, of any knowledge, information or data contained in this document, or due to any inaccuracy, omission or error therein contained.

All Intellectual Property Rights, know-how and information provided by and/or arising from this document, such as designs, documentation, as well as preparatory material in that regard, is and shall remain the exclusive property of the SAFELiMOVE Consortium and any of its members or its licensors. Nothing contained in this document shall give, or shall be construed as giving, any right, title, ownership, interest, license or any other right in or to any IP, know-how and information.

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 875189. The information and views set out in this publication does not necessarily reflect the official opinion of the European Commission. Neither the European Union institutions and bodies nor any person acting on their behalf, may be held responsible for the use which may be made of the information contained therein.

Publishable summary

The main objective of the reported activity is the adaptation of the process parameters defined in Task 4.3 (*Electrode and electrolyte processing development at small scale*) on pilot line equipment at several kg-scale for the manufacturing of several meter-length strips of electrodes and solid electrolyte layer (SEL) for large cells.

In this context, the document collects information about the manufacturing of Level 2 (L2) positive and negative electrodes, and membrane towards the development and fabrication of “Li|SE|NMC811” GEN1 solid state cells with targeted capacity of 10 Ah. The developed and upscaled solid electrolytes and solid-state positive electrodes have been validated in solid state coin and pouch cells with nominal capacity up to 1 Ah.

Concerning composite positive electrode, formulations based on the “NMC811|Carbon additive|Catholyte” system have been developed using NMC811, carbon based conductive additives, polymers, and other compounds such as ionic liquids and plastic crystals to improve the ionic conductivity, and binders to improve processing feasibility and mechanical properties. As result, solid-state composite cathodes with loading up to 3.0 mAh/cm² have been successfully developed and upscaled.

Regarding the solid electrolyte layer, membranes formulated with polymers and Li ion conductive ceramic materials (LATP) have been developed and successfully upscaled. Since the process/chemistry of the solid electrolyte membrane (SEL) was incompatible with SAFT automatic line, the manufacture of the SEL was done fully manually. Despite the manual process being laborious and time-consuming, a large number of SEL were prepared gradually (week after week) prior to receiving the upscaled cathodes.

After evaluation of Li-50 μm (L1) then Li-40 μm (L2) in handling and considering the energy density required, we decided to go ahead with L2 for the rest of the project.

Appendix - Acknowledgement

The author(s) would like to thank all the partners in the project for their valuable comments on previous drafts and for performing the review.

Project partners:

#	Partner	Partner Full Name
1	CIC EnergiGUNE	CENTRO DE INVESTIGACION COOPERATIVA DE ENERGIAS ALTERNATIVAS FUNDACION, CIC ENERGIGUNE FUNDAZIOA
2	SCHOTT	SCHOTT AG
3	UMICORE	UMICORE
4	HYDRO-QUEBEC	HYDRO-QUEBEC
5	SAFT	SAFT
6	RENAULT SAS	RENAULT SAS
7	TME	TOYOTA MOTOR EUROPE NV
8	IKERLAN	IKERLAN S. COOP
9	CEA	COMMISSARIAT A L ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES
10	CIDETEC	FUNDACION CIDETEC
11	TUB	TECHNISCHE UNIVERSITAT BERLIN
12	RWTH AACHEN	RHEINISCH-WESTFAELISCHE TECHNISCHE HOCHSCHULE AACHEN
13	ABEE	AVESTA BATTERY & ENERGY ENGINEERING
14	LCE Srl	LIFE CYCLE ENGINEERING SRL
15	UNIRESEARCH BV	UNIRESEARCH BV