

Prospective Life Cycle Assessment of a smart battery cell

Mesquita Bordalo Da Costa, Daniele; Lavigne Philippot, Maeva; Berecibar, Maitane; Messagie, Maarten

Publication date:
2023

License:
Unspecified

[Link to publication](#)

Citation for published version (APA):
Mesquita Bordalo Da Costa, D., Lavigne Philippot, M., Berecibar, M., & Messagie, M. (2023). *Prospective Life Cycle Assessment of a smart battery cell*. Poster session presented at SETAC Europe 33rd Annual Meeting, Dublin, Ireland.

Copyright

No part of this publication may be reproduced or transmitted in any form, without the prior written permission of the author(s) or other rights holders to whom publication rights have been transferred, unless permitted by a license attached to the publication (a Creative Commons license or other), or unless exceptions to copyright law apply.

Take down policy

If you believe that this document infringes your copyright or other rights, please contact openaccess@vub.be, with details of the nature of the infringement. We will investigate the claim and if justified, we will take the appropriate steps.

Based on a prospective Life Cycle Assessment, sensors preventing earlier degradation and failure mechanisms of battery cells can be selected



Prospective Life Cycle Assessment of a smart battery cell

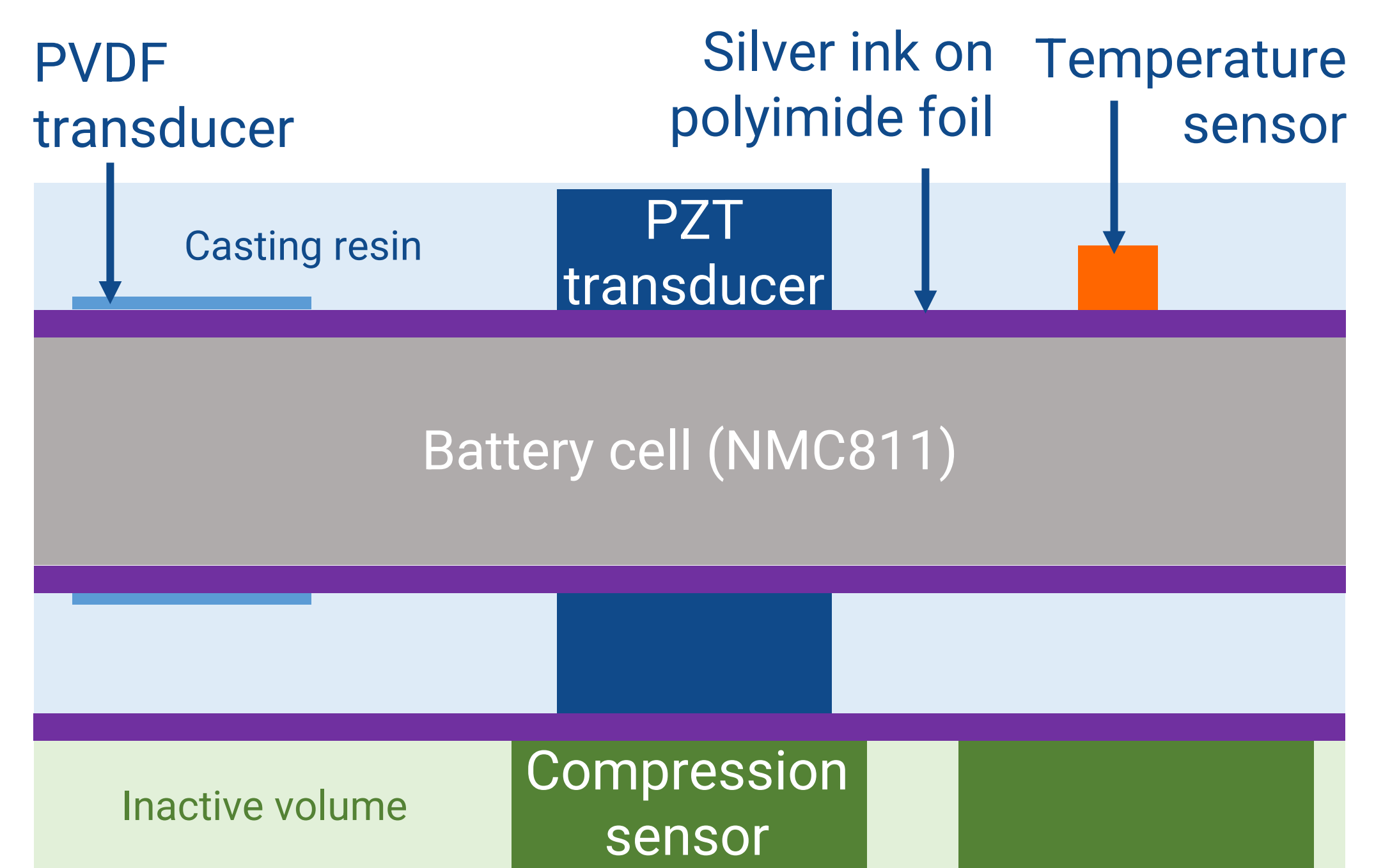
Daniele Costa^{1*}, Maeva Lavigne Philippot¹, Maitane Bercibar¹ and Maarten Messagie¹

¹ EVERGi Research Group, Mobi Research Center, ETEC Department, Vrije Universiteit Brussel, Pleinlaan 2, 1050 Brussels, Belgium

* Corresponding author: daniele.costa@vub.be

Prototype smart battery cell

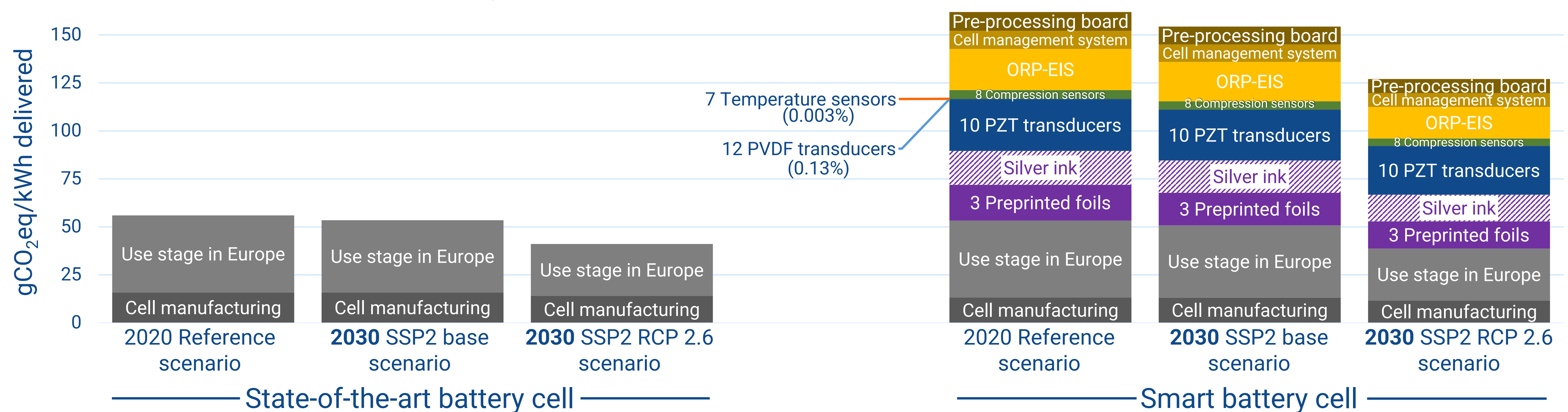
- Smart battery cell = Battery cell + **acoustic, mechanical, and thermal sensors** + advanced impedance spectroscopy (ORP-EIS) + cell management system + pre-processing board.
- Detection of degradation and failure mechanisms via sensors and dedicated cell model.
- Comparison with a state-of-the-art battery cell.
- Assumption of a 20% longer cycle life than the state-of-the-art cell.



Legend: NMC = Lithium nickel manganese cobalt oxide, PZT = lead zirconate titanate, PVDF = polyvinylidene fluoride.

Prospective Life Cycle Assessment

- Impacts on **climate change** in 2020 and 2030. GWP100a characterization factors with the addition of hydrogen and biogenic CO₂ uptake and release flows.
- 2 scenarios: SSP2-base (~3.5°C climate target) and SSP2- RCP 2.6 (~2°C climate target).
- Superstructure prospective database (based on ecoinvent 3.8) and the premise library.
- Functional unit = 1 kWh of delivered energy.



Take away messages & further developments

- Adding **sensors** to battery cells increase their future impact on **climate change**, even if it allows a 20% longer battery life.
- Silver** is a major contributor, but at lab scale, the waste rate is 80% and silver manufacturing is **not directly updated in the databases**.
- Temperature** sensors have the lowest impact among all the sensors.
- Optimizing the manufacturing process (**economies of scale**).
- Identifying the **necessary sensors**, based on their marginal impacts on the use phase.
- Assessing **circularity**: the potential for **2nd life** and the **recyclability**.

Extended abstract



ELECTROMOBILITY RESEARCH CENTRE



EVERGI RESEARCH GROUP



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 957221.