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PHOENIX: Revolutionising battery technology for a sustainable future

This Horizon Europe project started in 2023 and will support the development of smart, technologically advanced and sustainable European batteries

[Brussels, May 2024] The PHOENIX project is an EU-funded project launched in May 2023 that aims to usher in a new era of smart, eco-friendly batteries. The next generation batteries will prioritise safety, durability and environmental sustainability. The PHOENIX project seeks to explore a range of smart functionalities in terms of self-healing, sensing, and triggering. Thanks to the integration of an advanced Battery Management System (BMS) to these functionalities, detecting different kinds of degradation in performance and evaluating the battery's overall quality will be possible: batteries' lifetime will improve up to +100% (from 250 to 500 charging cycles).

How can the growing demand for energy be met with a sustainable approach?

As the demand for batteries skyrockets in electric mobility, grid energy storage, and consumer electronics, the PHOENIX project takes centre stage in addressing critical challenges. Despite the projected tenfold increase in demand over the next decade, the acceptance of batteries hinges on reducing costs over their lifetime while enhancing performance, reliability, and safety.

PHOENIX is working on a transformative approach by exploring the integration of self-healing, sensing, and triggering functionalities into batteries. This endeavour aims to develop cells with prolonged lifespans, capable of detecting and preventing degradation, fostering sustainability, and reducing costs. Prototyping and demonstrations will take place in Generation 3b and 4a Li-ion batteries, designed for high voltage and fast charging, suitable for both electric mobility and stationary applications.

Additionally, PHOENIX addresses manufacturing concerns such as cost and mass production, recycling feasibility, and sustainability assessments. The aim is to slash specific battery costs by 10% and enable the recycling of self-healing materials without significant alterations to current recycling processes.

Project scientific coordinator (Joris de Hoog – VUB)

As the European and global lithium-ion battery industry expands and is driven by industrial and private demands for safety, longevity, cost and sustainability, it is positive that projects like PHOENIX aim to meet these demands. During the project, we will keep the bigger industrial picture in mind, such that the technology developed can be scaled up and used in traditional cell production lines.

Partners and BATTERY 2030+ initiative:

The PHOENIX project is coordinated by the Battery Innovation Centre at MOBI-Vrije Universiteit Brussel (VUB) and is a **partnership** of 4 research organisations (CIDETEC, DLR – German

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Aerospace Center, Fraunhofer ISC, CSEM), 1 university (VUB) and 4 small-to-medium enterprises experts (Leclanché, Accurec-Recycling, Deep Blue srl, ENWAIR) in materials, sensors, modelling, BMS, recycling and battery manufacturing.

PHOENIX is part of the **BATTERY 2030+** large-scale initiative, which aims to shape the future of battery technology. The ambition of the Battery 2030+ is to make Europe a world-leader in the development and production of the batteries of the future. These batteries need to store more energy, have a longer life, and be safer and more environmentally friendly than today's batteries in order to facilitate the transition to a more climate-neutral society. The goal is to create more environmentally friendly and safer batteries with better performance, greater storage options and longer life.

PHOENIX is a European collaborative project committed to advancing battery technology for a greener future. By seamlessly integrating self-healing, sensing, and triggering functionalities, we are not only tackling the imminent challenges faced by batteries but working on a transformative shift in the landscape of energy storage technology.

Project manager (Inès Boursot – VUB)

We are especially interested in the application of self-healing anodes and electrolytes in solid-state battery composition, as this could enable the commercialisation of this type of safe and reliable cell on a large scale. At VUB's pilot line infrastructure, we will integrate the innovative materials, sensors and digital management systems into test and prototype cells and investigate the effectiveness of the developed technology, while working together with the industry to ensure manufacturability on existing cell production lines.

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Figure 1 - Photo of the partners during the kick-off meeting

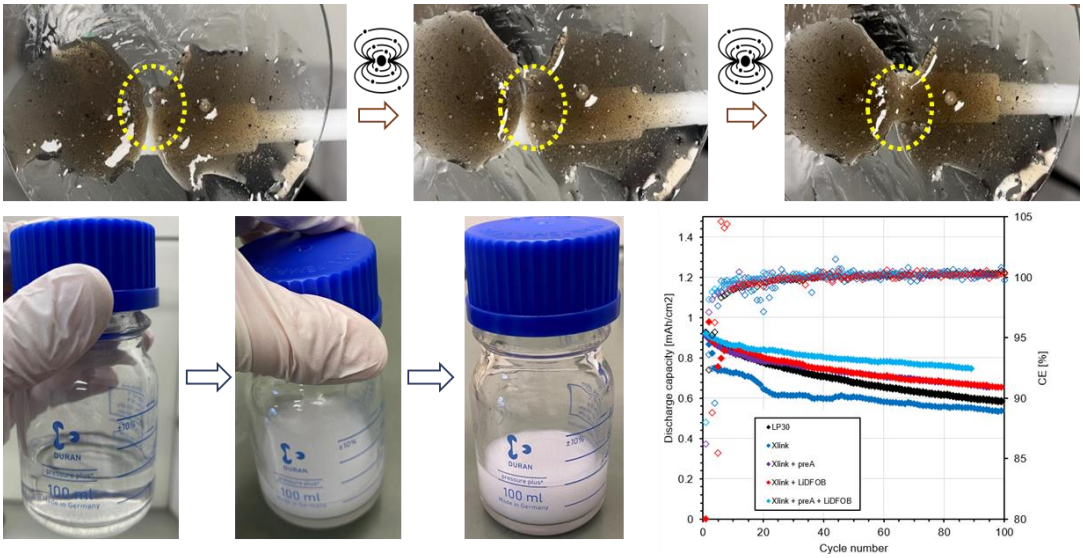

Figure 2 - Preliminary trials for synthesis of magnetic triggering self healing polymer (top) and metal-organic framework synthesis (bottom-right), selecting crosslinker for thermally triggered, self-healing, in-situ polymer electrolyte according to cycling results

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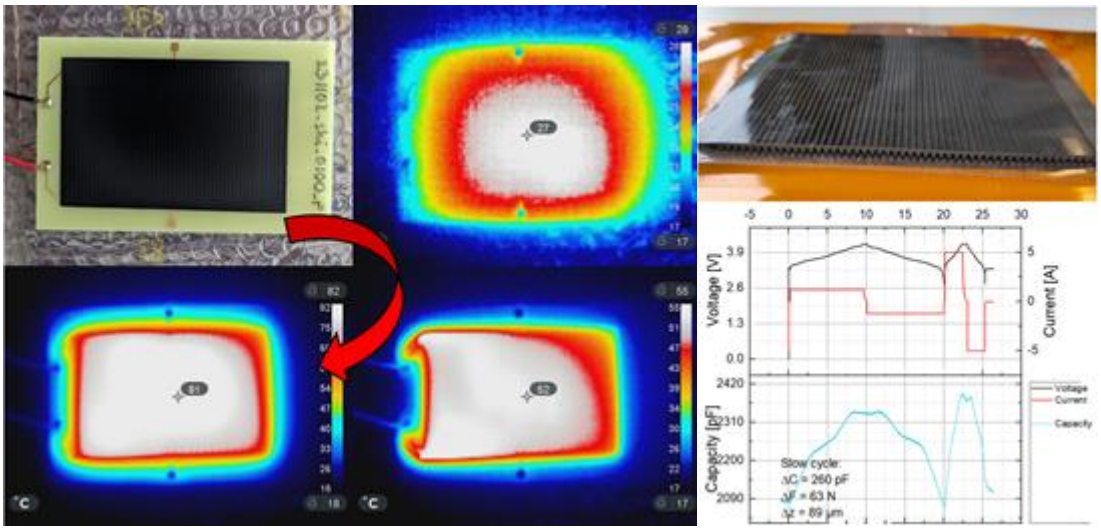

Figure 3 - Self-regulated temperature trigger (left) and prototype of expansion sensor based on dielectric elastomer including cycling results (right)

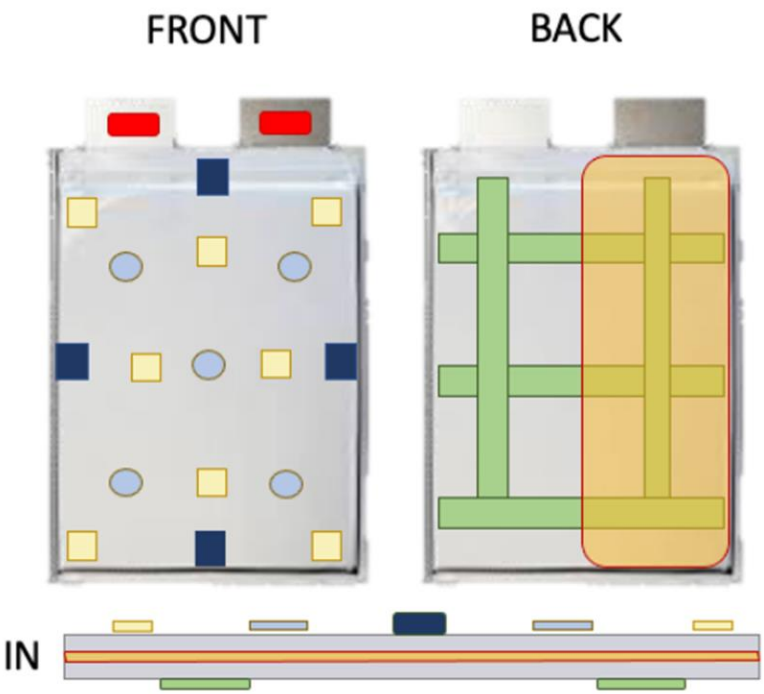

Figure 4 - 1Ah multilayer pouch cells with integrated self healing functionalities and sensors will be developed. Besides, the feasibility of integrating multi-sensors and multi self-healing functionalities, as well as the electrochemical performance of the cells will be analysed.

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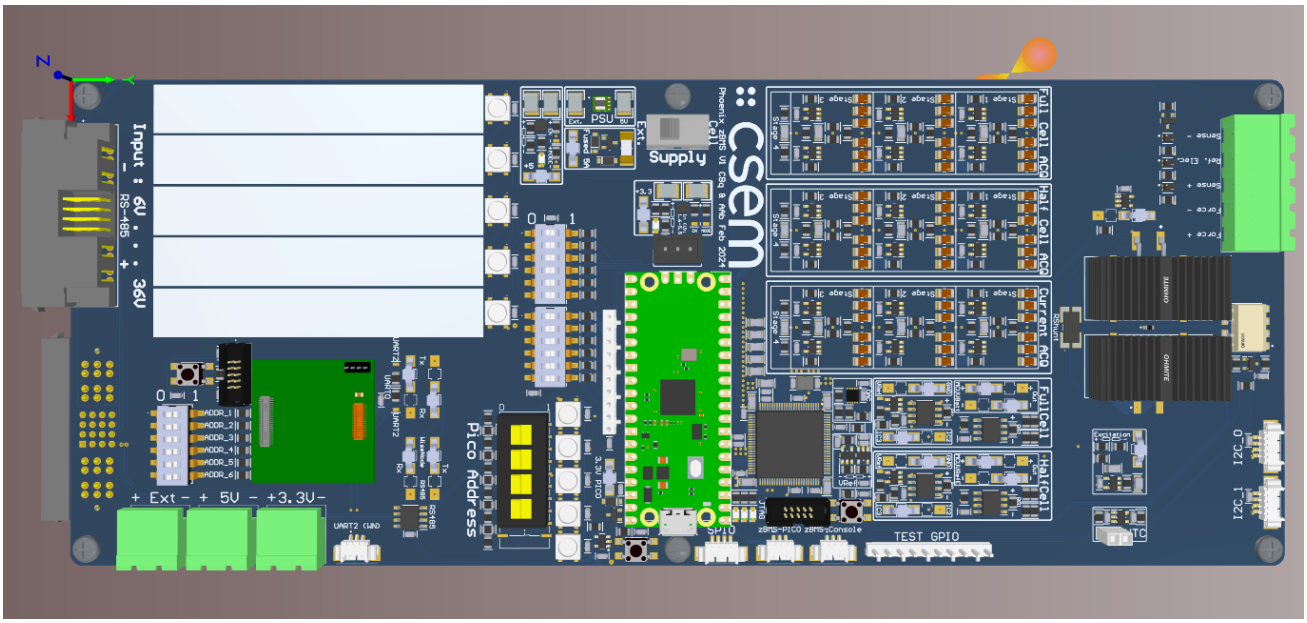

Figure 5 - BMS V1 3d view: The first version of the BMS was sent to production mid-February 2024 and should arrive to CSEM early March. In parallel the required software is being developed. Collaborative work ensured that sensors and self-healing elements will integrate efficiently.

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