



## Newsletter June, 2022

**The vision** for BATTERY 2030+ is to invent the batteries of the future, providing European industry with disruptive technologies and a competitive edge across the full value chain, that will enable Europe to take the lead in battery science and technology.

**This newsletter** gives you an update on what's going on within the initiative. Enjoy your reading!



### A moment with Kristina Edström, Coordinator of BATTERY 2030+

The summer is approaching and the battery research in Europe is livelier than ever. Our six projects BIG-MAP, Instabat, Sensibat, Spartacus, Bat4Ever, and Hidden are now starting to produce results both with quality and in quantity. You can read more about Spartacus in this newsletter and about the other projects on their respective webpage.

This spring the Battery 2030+ initiative has been very busy. We have had four excellence seminars: M. Rosa Palacin, Sandrine Lyonnard, Alejandro A. Franco and Maximilian Fichtner. If you have not seen them you can find them uploaded on our [webpage](#). We have also published our roadmap and a number of in-depth scientific papers in [Advanced Energy Materials](#) (so you recharge your batteries this summer by reading them). The general roadmap is also updated and again, you can find it on our [web](#). We have also attended a large number of meetings and conferences, both at policy level and scientifically.

From all of us in Battery 2030+ we wish you a very relaxing summer!





## BATTERY 2030+ Young Scientist Event

A joint effort by the four Universities, POLITO Politecnico di Torino, UU Uppsala University, Vrije Universiteit Brussels VUB, Warsaw University of Technology WUT organized by Silvia Bodoardo

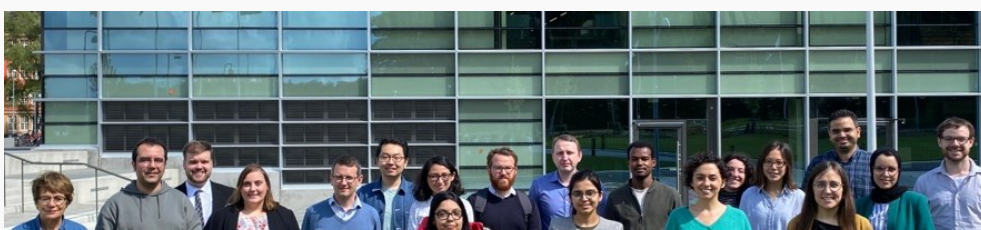
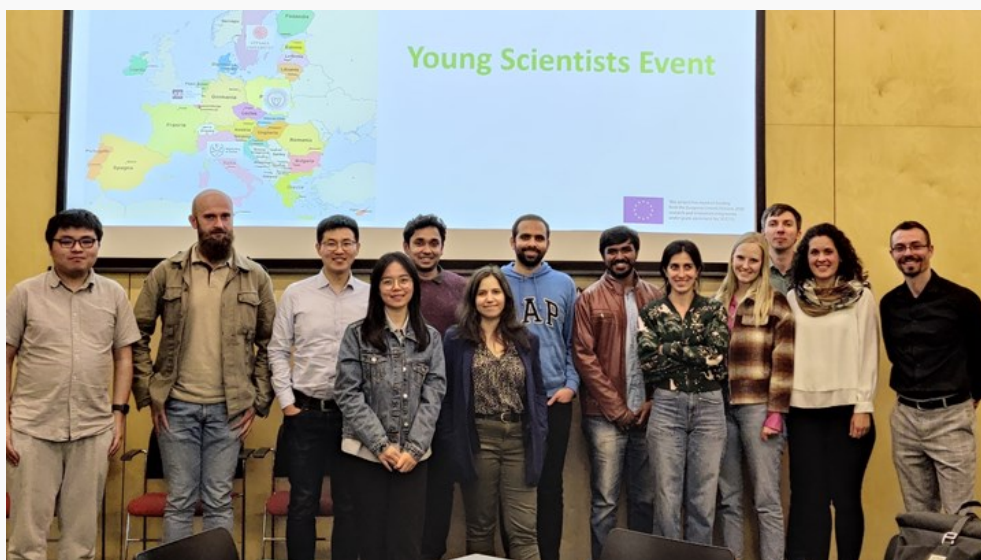
*The BATTERY 2030+ community gathered young scientists for a workshop that took place across four European cities simultaneously.*

The event was designed to involve young people from all over Europe in an important and open discussion of the electrification and decarbonisation of Europe by 2050, where the future development of batteries in Europe plays a big part. The young scientists discussed the developments and innovations that are needed in this sector for the future and also how this will impact Europe's economy and society.

This young scientist event aimed to engage young scientists (no more than 7 years after Ph.D.) to express their ideas about the future battery research landscape by providing input on the BATTERY 2030+ roadmap and curricula. The scientists were selected in order to gather a wide range of experience and competences, both within and outside the battery field. Gender equality was also been taken into consideration.

The event was held simultaneously at four different Universities in Europe defined by their geographic position (e.g. POLITO Politecnico di Torino, UU Uppsala University, Vrije Universiteit Brussels VUB, Warsaw University of Technology WUT). The four Universities were connected live via the web which allowed open discussions and provided the broadcasting of short lectures given by well-known people in industry and curricula. These lectures inspired and engaged the selected participants.

At the end of the day the results of the discussions were used to create a Manifesto. The Young Scientist Manifesto will be published by BATTERY2030+ and showcased at the 2022 **Nano Innovation Conference and Exhibition**.







Top image 1, Young scientist participants at Vrije Universiteit Brussels VUB. 2, Young scientist participants Warsaw University of Technology WUT. 3, Young scientist participants UU Uppsala University. 4, Young scientist participants POLITO Politecnico di Torino





Spartacus project team

## ***SPARTACUS sensing the status***

***To understand the processes and ways a battery ages, you need to be able to measure voltage, conductivity, temperature and other parameters. However, most batteries lack sensors that measure the condition during operation. The sensors have simply been too expensive, too clumsy or affected the battery's performance. To be commercially viable, the sensors must be much smaller and more sensitive. **Spartacus**, one of the six research projects within the Battery 2030+ initiative, has taken on this challenge by development of non-invasive sensors.***

In line with the EU Green Deal ambitions for secure, clean and efficient energy storage and supply, Spartacus develops new sensors for battery cells. To improve battery lifetime, charging time and battery safety as well as reduced battery costs is needed, particularly in the light of the dramatic increase of electric vehicles. The global objective of the Spartacus project is to allow for fast charging of battery modules without any substantial negative impact on lifetime/cycle life by the implementation of an array of mechanical, acoustic, thermal and advanced impedance sensors integrated on individual cells. The latter will be connected to cell and battery management system (BMS) to allow for more efficient battery usage. The BMS will rely on real-time battery models that are updated thanks to the sensed values.

- *Battery manufacturers and suppliers have difficulties to reach further cost reduction and performance improvement of existing lithium-ion-technologies. By our technology, the state of the battery cells will be defined with high accuracy. Thereby high energy density lithium-ion batteries not only can be operated for a longer time closer to their theoretical limit but also charged much faster than the common battery management systems nowadays allow, says Spartacus project leader Gerhard Domann, Fraunhofer ISC.*

A reduction of 20 percent charging time without any negative effect on lifetime by exploitation of sensor data is targeted. The project focus on mechanical and acoustic sensors completed by electrochemical impedance measurement and temperature sensors including the development of an advanced BMS (Battery Management System), novel battery models, and a standardisation procedure, which is on its way. Another important aspect is to fit the sensors for industrial purposes, including technology for packaging and assembling made economic and environmentally friendly. The validation of this concept will be conducted in Hardware in the loop (HIL) system, enabling the validation of



different BMS strategies and quantifying the improvement done compared to a conventional BMS.

### **Ultrasonic sensing**

Two different technologies of ultrasonic sensors are developed, which are screen-printed piezopolymers as well as piezoceramic transducers. By measuring the time-of-flight of the acoustic signals throughout the battery cell, changes in the electrodes density and its Young's Modulus can be detected and linked to state of charge as well as state-of-health. The ultrasonic sensors have to be implemented properly in order to guide the sound efficiently through the cell.

### **Temperature measurement**

Spartacus has equipped a battery with semiconductor sensors in order to measure the temperature on different spots all over the battery. In order to realize a good thermal contact to the cell Spartacus uses digital, highly sensitive sensors with very low form factors that enable a reduced number of connecting lines and wiring.

### **Compression sensing of batteries**

In order to detect reversible and irreversible changes of thickness of a battery cell Spartacus has adapted Dielectric Elastomer Sensors (DES) on battery cell-level. Using segmented compression sensors, the state of charge can be monitored by the geometrical change of the sensor transferred from the battery cell under packed conditions. Cell deformation can then be translated into compression load of the cell. The sensors are sensitive enough to measure changes in the  $\mu\text{m}$  regime by detecting the capacity changes of the DES.

All the aforementioned acoustic, mechanical and thermals sensors are completed by an enhanced electrochemical impedance spectroscopy (ORP-EIS) that is based on an electronic set-up that analyses additional information by dealing with different noise levels.

### **Much applause at the review meeting for the Spartacus team**

In the recently held review meeting, Spartacus was able to convince with the project results achieved so far. The EU-appointed reviewers certified the topics as highly relevant to application and commercialization as well as outstanding scientific work at the cutting edge of technological progress.

*Eva Regårdh*



# BATTERY 2030+ Midterm review

May 16th and 17th BATTERY 2030 PLUS had our midterm review in Brussels. A big thank you to **CIC EnergiGUNE** and **Cidetech** from our core group that helped us host this event at the Basque Delegation in Brussels, we are truly grateful for their excellent hospitality.

The 16th was open to supporting organisations and partners in our Battery 2030+ community. We started out with each work package leader presenting their task and work package progress. In the afternoon, we had group discussion around our SWOT analyses and next phase discussions which was very fruitful. The night ended with dinner and mingle at a restaurant close by.

The 17th of May was the internal review which was closed for the reviewers and work package leaders. Our project coordinator Kristina Edström along with all the work package leaders presented an overview of our work and success so far. Our project officer Aymard De Touzalin also attended naturally. We had a great review and has accomplished a lot in this short time we also got some terrific feedback to take in to consideration and help to move us further in to the next phase.

