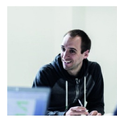
sensibat

NEWSLETTER SPRING 2021

Welcome to the first SENSIBAT Newsletter!



Today more than ever, due to the unexpected situation that limits the possibility to meet physically, this first issue of a series of newsletters offers us the possibility to announce the SENSIBAT project. As well as share our results with the community that investigates new developments to have a better knowledge and control of the batteries.

When we started to envision what we could do to achieve a more accurate control and increased performances of the battery throughout its lifetime, based on new cell-integrated sensing technologies, we made assumptions on cell internal temperature, pressure and EIS measurement functionalities. This finally led to the SENSIBAT project proposal. It is stimulating to know that we share this vision with the European Commission and with complementary projects within the same call with which we collaborate within the framework of the Battery 2030+ initiative, INSTABAT and SPARTACUS projects.

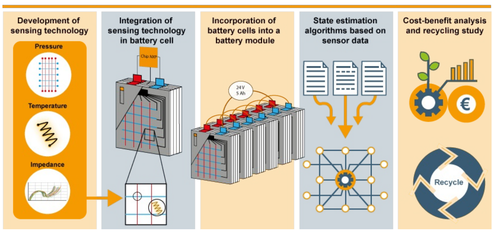
SENSIBAT's overall objective is to develop a sensing technology for Li-ion batteries that measures, in real-time, the internal battery cell temperature, pressure (e.g. mechanical strain, gas evolution), conductivity and impedance (separately for the anode, cathode and electrolyte). In this initial phase of the project, we established the specifications and requirements of these new sensing technologies, facing the multiple challenges of integrating any element within a Li-ion battery. During the first months of the project, we built the foundations to achieve satisfactorily all the objectives of the project. Fully new 2D-materials have been optimized to produce completely new sensors directly deposited on the cell components to monitor the internal impedance of the cell. Which you can find in the "Results" section of the SENSIBAT project website.

Improving the monitoring to understand the changes within a battery cell under various operation conditions is key to mass introduction of this technology in high demanding applications. Our ambition is to provide data and insights from these new sensing technologies. As well as to improve state estimator functions based on an improved understanding of how, where and when degradation and failure mechanisms occur to have more reliable batteries.

Our work started less than eight months ago and will hopefully end by September 2023. By that time, we'll be able to tell whether our approach has been successful and we will know what kind of legacy, in the form of new sensors and their functionalities, it can leave to the European Li-ion Battery community.

I look forward to our next newsletter,
Take care,

Iñigo Gandiaga
SENSIBAT Project Coordinator,
IKERLAN (Member of The Basque Research and Technology Alliance - BRTA)



Specifications, requirements and testing plan

After a little bit more than 7 months into the project, we are happy to present the [redacted]. In order to generate requirements for the cells, integrated sensors and the resulting battery modules that are developed in the project, a challenging and relevant use case had to be found. Based on a demanding sports car application (Porsche Taycan) and a common drive cycle (WLTP - Worldwide Harmonized Light Vehicles Test Procedure) the requirements were derived in a top-down approach, where power and energy requirements were scaled down to fit the scope of the cell development in the project without sacrificing comparability.

In order to quantify if the defined requirements are met, corresponding tests were defined in a next step. The aim is to show how the additional sensor information from sensors that are integrated into the battery cells can improve battery usage in terms of increased vehicle range, faster charging and longer battery life.
© Image of Battery Testing Lab by AIT

Adaptation of level 1 sensors for incorporation into battery cells

Monitoring of temperature and pressure inside lithium ion cells by the implementation of SENSIBAT-sensors will allow the estimation of the present cell condition during operation. These sensors will be attached to one side of the stacked battery electrode inside the cell and provide information on the cell's temperature or pressure by a separate wiring feedthrough. To realize such sensor devices, different aspects for cell integration, like sensor wiring, feedthroughs and encapsulation for chemical resistance against electrolyte must be considered.

The SENSIBAT-partners identified suitable sensor materials for the adaptation of existing temperature sensors. The first sensor structures have been manufactured and characterized based on existing layouts to evaluate processability and sensitivity. The results of these works are currently used to design revised layout concepts.

Occurring internal pressure rises will be detected with sensor concepts based on proven capacitance read-out concepts. Feed-through tests with respect to the integrity of sensor encapsulation and battery pouch will represent the working focus of the upcoming months.

Prototyping of baseline cells

The presence of integrated sensors must not influence the electrochemical performance of the cell and its safety. This will be determined by the comparison of cells without sensors (baseline cells) and cells with integrated sensors by electrochemical, safety and condition monitoring tests.The chosen cell formats are 1Ah and 5Ah pouch cells with stacked design and incorporate graphite based negative, NMC622 based positive electrode materials and standard liquid electrolyte. NMC622 material was chosen, because it is expected to be the battery chemistry with the highest worldwide demand for the coming 5 years.

The electrodes have been produced and shipped to the different partners responsible for cell production. Currently, these materials are used to manufacture baseline cells, which will be followed by an intensive investigation according to specified characterization routines.

SENSIBAT is part of the Battery2030+ initiative. Battery 2030+ is the large-scale and long-term European research initiative with the vision of inventing the sustainable batteries of the future, providing European industry with disruptive technologies and a competitive edge throughout the battery value chain and enabling Europe to reach the goals of a climate-neutral society envisaged in the European Green Deal. Subscribe to the Battery2030+ newsletter.

BATTERY 2030+

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