Encontro Ciência 2021

INSTABAT — Innovative physical/virtual sensor platform for battery cell

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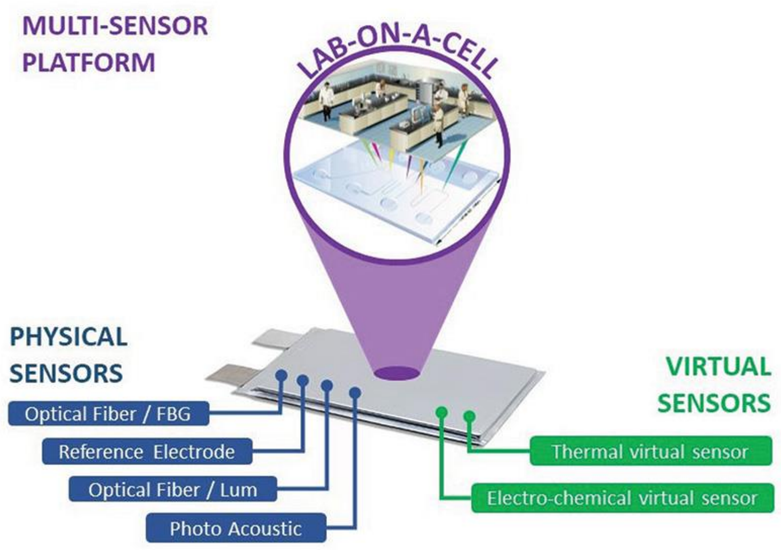
Project Abstract

INSTABAT *Is intended to monitor in operando, key parameters of a Li-ion battery cell, in order to provide higher accuracy states of charge, health, power, energy and safety (SoX) cell indicators, allowing us to improve the safety and the quality, reliability and life (QRL) of batteries.*

INSTABAT is part of the ***BATTERY 2030+*** Initiative.



Project reference
955930

Contract type
Research & Innovation Action

Topic
Call H2020-LC-BAT-2019-2020

Project type
Research and technological development

Project cost
371,6 number of person months

Project funding
3,999,522.50 €

Consortium Members:

- UNIVERSIDADE DE AVEIRO (**UAVR**)
- COMMISSARIAT À L'ENERGIE ATOMIQUE ET AUX ENERGIES ALTERNATIVES (**CEA**)
- CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (**CNRS**)
- INSTITUT NATIONAL DES SCIENCES APPLIQUÉES DE LYON (**INSA**)
- INFINEON TECHNOLOGIES AG (**IFAG**)
- FAURECIA SYSTEMES D'ECHAPPEMENT SAS (**FAURECIA**)
- VARTA MICRO INNOVATION GMBH (**VMI**)
- BAYERISCHE MOTOREN WERKE AKTIENGESELLSCHAFT (**BMW**)

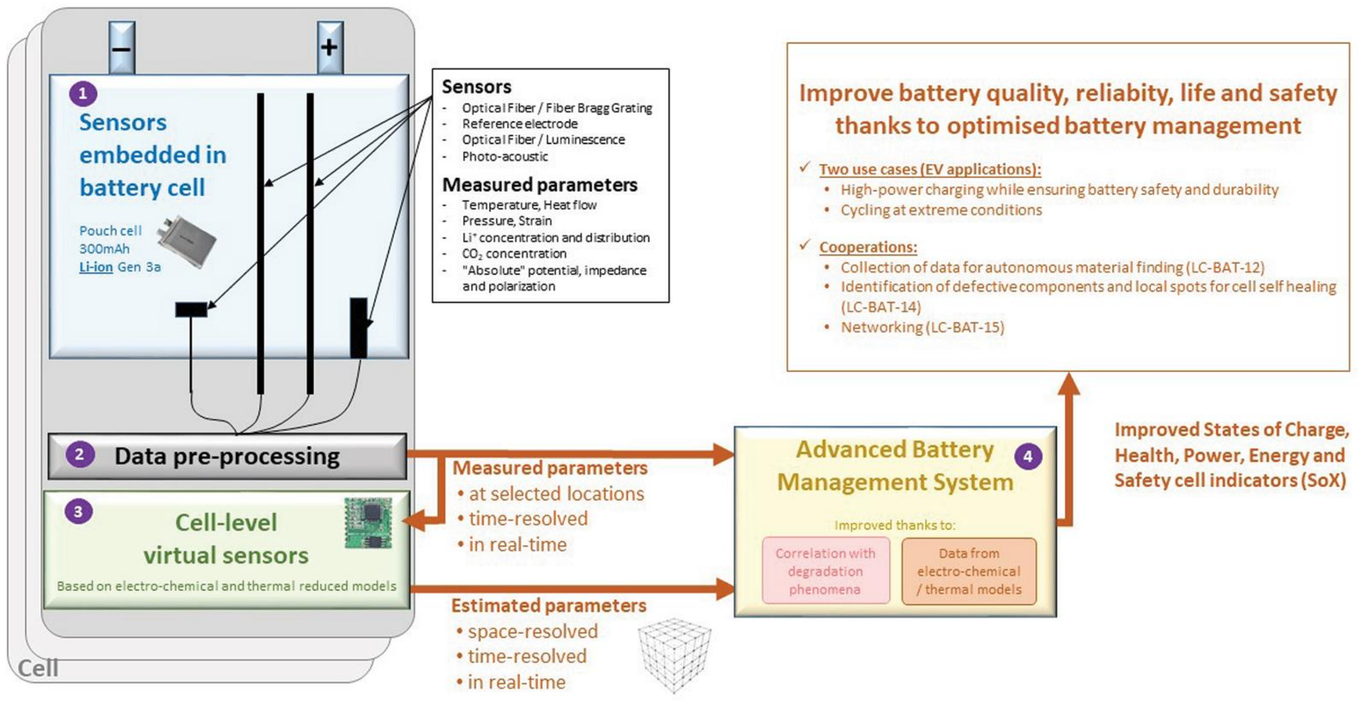
Universidade de Aveiro

Objectives

INSTABAT will develop a proof of concept of smart sensing technologies and functionalities, integrated into a battery cell and capable of:

- ✓ performing reliable in operando monitoring (time- and space-resolved) of key parameters (i.e., temperature and heat flow, pressure, strain, Li^+ concentration and distribution, CO_2 concentration, "absolute" impedance, potential and polarization) via:
  - ✓ four embedded physical sensors (i.e., optical fibers with fiber Bragg grating and luminescence probes, reference electrodes, and photo-acoustic gas sensor) and
  - ✓ two virtual sensors (based on electro- chemical and thermal reduced models);
- ✓ correlating the evolution of these parameters with the physico-chemical degradation phenomena occurring at the heart of the battery cell;
- ✓ improving battery functional performance and safety, thanks to enhanced BMS algorithms providing in real-time higher accuracy SoX cell indicators (taking the measured and estimated parameters into consideration).

CONCEPTION OF SENSING TECHNOLOGIES INTEGRATED INTO A BATTERY CELL

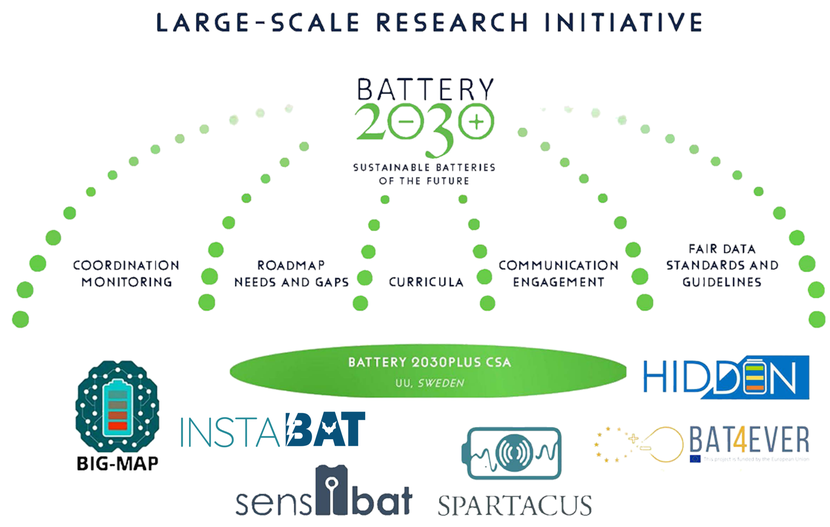


In a nutshell, with **INSTABAT** the battery will no longer be a black box. It is expected that such a disruptive approach of monitoring/estimating physical parameters and correlating them with battery degradation phenomena will open new horizons to:

(1) bring battery performances to their theoretical limits;
(2) reduce battery safety margins;
(3) improve the optimization of the cell use through a better BMS using data from the sensors;
(4) enable battery self-healing and facilitate battery 2nd life usage.

BATTERY2030+

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.



Final remarks

The main results will be:

1. Proof of concept of a multi-sensor platform (comprising a cell prototype equipped with physical/virtual sensors and associated BMS algorithms providing SoX cell indicators in real-time);
2. Demonstration of the higher accuracy of SoX cell indicators;
3. Demonstration of improved cell functional performance and safety through two use cases for EV applications;
4. Techno- economic feasibility study covering, for example manufacturability, and adaptability to other cell technologies.

INSTABAT smart cells will open new horizons to improve cell use and performances (e.g., by reducing ageing, allowing decrease of safety margins, triggering self-healing, and facilitating second life).

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