INSTABAT EU-project – Innovative physical/virtual sensor platform for battery cell

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Since 2019, according to the European Green Deal, several initiatives have been targeting to transform the European Union economy for a more sustainable future, reducing the emission of greenhouse gases (CO_2) and improving the energy transition by mitigating climate change [1]. BATTERY 2030+ research initiative aims to contribute to carbon neutrality by developing more sustainable batteries for the future. The INSTABAT EU-project is integrated in this initiative and focussed in the development of new methodologies to sense critical parameters, towards smart batteries [2].

UAveiro/i3N team is dedicated in the designing of innovative optical fiber and virtual sensors for internal and simultaneous sensing of lithium-ion battery cells (LiBs) safety parameters, such as temperature, strain/pressure, and state of charge. In particular, customized optical fiber sensors (OFS), based on fiber Bragg gratings recorded in standard and polarization-maintaining fibers, and hybrid sensors based on Fabry-Perot interferometers are being developed and instrumented into LiBs to simultaneously monitor internal and external parameters during galvanostatic cycles [3-5]. Furthermore, studies with a Particle Filter and the consecutive comparison to an Extended Kalman Filter have been carried out to predict temperature and state of charge [6]. The results obtained shows good feasibility and reproducibility, indicating that by operating as a multiparameter decoupled system, they can decrease the complexity and intrusiveness in batteries and simultaneously monitor different safety parameters. In this way, the sensing data recorded will be a useful tool to (1) be correlated with internal electrochemical events and the different battery states (SOX); (2) be integrated with machine learning (ML) algorithms for the virtual sensor's development; and (3) extend the battery quality, reliability, and life (QRL), as shown in Figure 1.

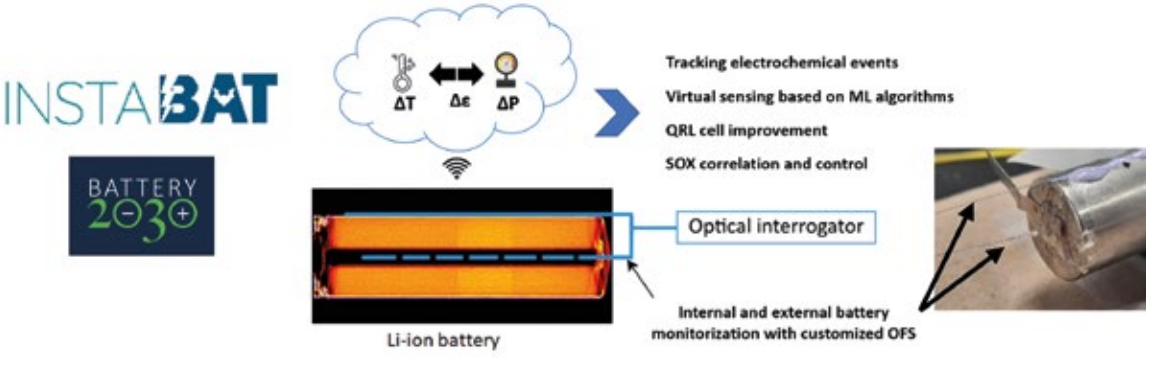

FIGURE 1
Schematic diagram of the developed monitoring system with fiber sensors for internal and external safety parameters tracking in LiBs, within the *INSTABAT* EU-project. The data from the sensed parameters are used to correlate with internal electrochemical events and different SOX, in order to develop ML algorithms for virtual sensing and QRL cell improvements.

Reference

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