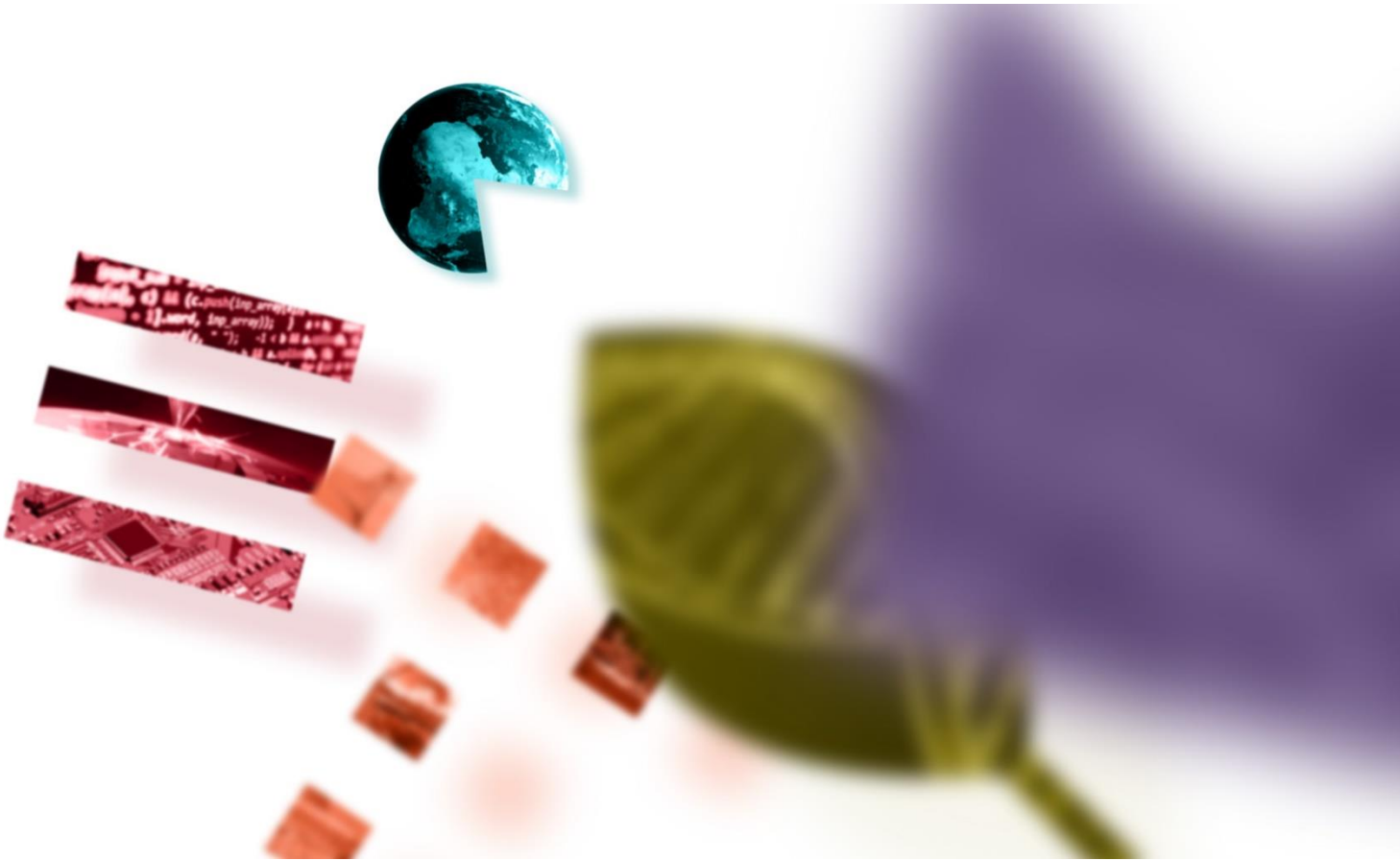
Technological Centre

Capabilities Horizon Europe

HORIZON-CL HORIZON-CL5-2023

CONTENT



HORIZON-CL5-2023-D2-02-01 Advanced materials and cells development enabling large scale production of Gen4 solid-state batteries for mobility applications

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
5/09/2023	8 M€	24 M€	3	IA

The scale-up of a process is a relevant step to enable the large scale of any production. The first task should be to evaluate the initial situation analyzing resources, current technologies, goals… It is essential to define the key processes, and the technological resources available. Sometimes this is not very clear, and a model based on AI simulations or Digital Twins could give fundamental information to ensure this scale-up.

In this way, simulation combined with AI interactions could generate good results reducing 20% of time spent and avoiding costly mistakes. In this operation, CETIM can combine different technological options and IT platforms, and make data analytics to extract conclusions to reach better decisions. These are all the capabilities for that:

- **Designing and deploying of different types of Digital Twin** (Asset Twin, Parts Twins, Unit Twins and Process Twins).
- Development of **AI simulation models adapted to the specific technologies and needs** of each process and project.
- Deployment of different **training models for the AI model** to ensure the future use of the application.
- Link of the **Digital Twin with robots or other control systems** of the process to contribute to the autonomous decision-making of the process converting the factory into a smart factory.
- **Simulation under different scenarios** focused on the energy consumption, economical KPIs, time wastes, efficiency, etc.

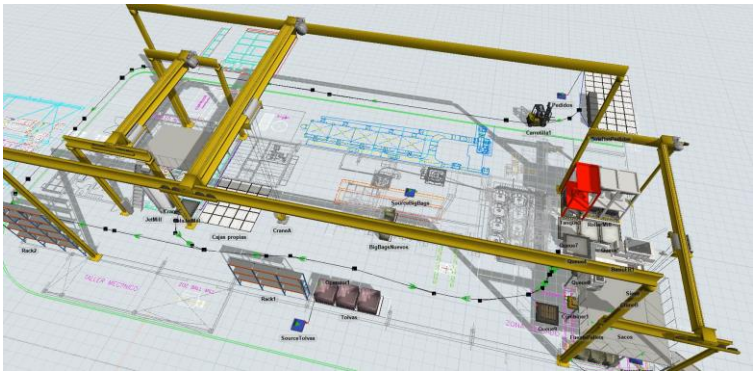


Figure 1. Example 1 of Digital Twins to study and simulate battery manufacturing process.

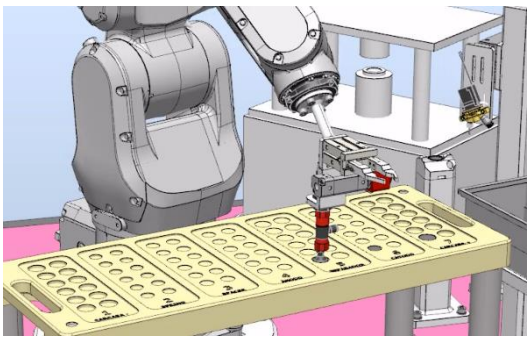


Figure 1. Example 2 of Digital Twins to study and simulate battery manufacturing process.

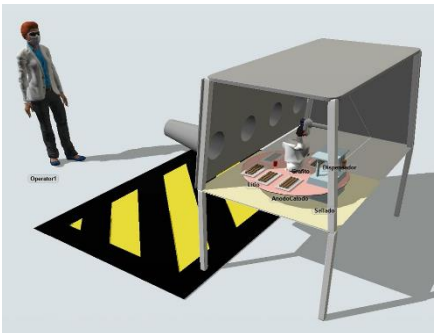


Figure 3. Example 3 of Digital Twins to study and simulate battery manufacturing process.

HORIZON-CL5-2023-D2-02-02: New Approaches to Develop Enhanced Safety Materials for Gen 3 Li-Ion Batteries for Mobility Applications (Batt4EU Partnership).

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
05/09/2023	5 M€	10 M€	2	RIA

Increasing the safety of the behaviour of lithium-ion batteries by replacing the components that promote phenomena such as thermal runaway, through the synthesis of compounds with more stable properties than the current ones, by sustainable ways and of high interest in waste valorisation.

Increasing the safety of the current configuration of batteries, in which explosive phenomena can occur, is promoted in the capabilities available to CETIM through several actions:

- Developing new cathode materials with no exothermal decomposition/reactions and preventing corrosion at current collector following different strategies such as doping or surface coating materials, design of new cathode materials based on safer chemistries, etc.

- Routes for the synthesis of new electrolyte formulations to reduce the Li-dendrite formation and the SEI decomposition by developing electrolytes with flame retardant additives and gel-type electrolytes, with carbonaceous precursors from waste generated in the paper industry, such as lignin, susceptible to be used in the gen 3 technology of lithium-ion batteries.

- Developing new stable anode materials following different approaches such as incorporation of new materials to replace graphite with a higher silicon content, surface coating materials, etc. The use of materials such as silicon improves the capabilities obtained in current storage technology.

- Developing new separator materials with flame retardants to improve the safety and the electrochemical stability.

- Developing new binder materials with thermal, mechanical and electrochemical stability based on the use of sustainable binders such as cellulose modified or lignin modified in combination with crosslinking polymers (PAA, PAN, etc.) to create structures that support the volume changes and improves the adhesion of the materials to the collector.

CETIM have been involved in different projects that tackle the aforementioned issues. One of this projects is, LION-HD in which CETIM implements the substitution of the current electrolyte used in lithium-ion technology (LiPF6 with a mix of carbonates solvents) by different ones gel-based from carbonaceous precursors from waste of paper industry, which is adapted to the inclusion of Silicon on the anode to improve the capacity achieved in these devices. Other similar projects are ECO-SMART BATT, VOLTA. From the point of view of substitution of the Li-ion chemistry, CETIM has the capability to develop new synthesis materials, new cells and test them.

Improvement of battery manufacturing processes through the creation of automation in the assembly stages of button cell configurations.

In order to facilitate the implementation of the materials of new developments on a larger scale, CETIM is also working in the following areas:

- Digitalization through the development of digital twins for a more exhaustive follow-up of the assembly processes.

- Robotization of the assembly process and assembly of the components of the cells to be tested to avoid the human errors and decrease the rate of defective cells. For a quick determination and characterization of the improvement routes of the selected technology, after the study of the material.

- Traceability of assembly and content based on critical raw materials for easy recycling at a later date, by creating a web-based database for consultation.

As an example of the works mention above, CETIM have worked on those topics in ECO SMART BATT project.

Equipment & facilities to work at lab and pilot scale in synthesis, composite formulations and characterization:

- Planetary Vacuum mixer (lab scale).
- Potentiostats/galvanostats (±5V, 0-5A): 16, 46 and more than 300 channels for coin and pouch cells.
- Tubular furnace (lab scale).
- Coating machine (lab scale).
- Vacuum oven (lab scale).
- Globe box.
- Electrode cutter machine (lab scale).
- Welder machine (lab scale).
- Winding machine (lab scale).
- Crimping machine (lab scale).
- Climatic chamber.

Figure 4. Some of CETIM's laboratory equipment

HORIZON-CL5-2023-D2-02-03 Creating a digital passport to track battery materials, optimize battery performance and life, validate recycling, and promote a new business model based on data sharing

TOPIC DEADLINE	BUDGET PER PROJECT	TOTAL BUDGET	EXPECTED NUMBER OF PROJECTS	TYPE OF ACTION
5/09/2023	8 M€	8 M€	1	IA

Digital passport using blockchain and other KETs technologies

The European Union (EU) has the commitment to take the Green Deal Industrial Plan to support the transition to climate neutrality, calling for the adoption of a Circular Economy and trying to get neutral mobility. One of the main tools in this transition will be the "green passport" for the batteries commercialized in the EU, which gives information about the carbon footprint in its manufacturing process, the ethical aspects of their materials and the content of recycled materials used.

Blockchain could be the key technology to track battery over its life cycle. CETIM has some expertise in deploying systems that include AI Algorithm, digital twins or sensors to automatize the information registration of the relevant data:

- Sensor and automatization tools to reduce the human influence on the registration process to reduce the risk of manipulation or errors in the introduction of the information. CETIM can select the most appropriate technology for each individual stage of the process to ensure the right registration of the data.

- Blockchain networks ensure the immutability of the information registered, due to its formed by a decentralized structure with a lot of nodes that must approve the different transactions done. Due to the need for approval for the different nodes, is practically impossible to change the information registered in the blockchain after its verification. This is the main reason to consider blockchain technology for applications that request a high level of trust and transparency. CETIM has used this tool to deploy different track controls based on blockchain, most of them for battery materials.

- Digital Twins based on AI models can be used to identify patrons in a huge volume of information. CETIM can deploy DTs that can predict the performance of the batteries considering the data stored in the BMS systems. In this way, it is pretended to identify the most common fails, improve the predictive maintenance of the batteries, or deploy an automatic diagnosis application to support their recycling.

Figure 5. Example 1 of blockchain applications to share information about battery manufacturing process.

Figure 6. Example 2 of blockchain applications to share information about

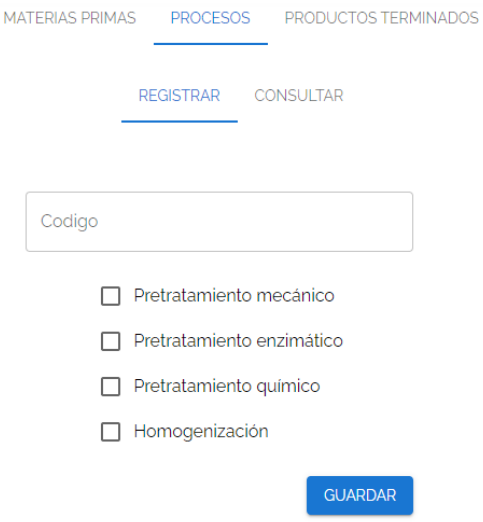


Figure 7. Example 3 of blockchain applications to share information about battery manufacturing process.

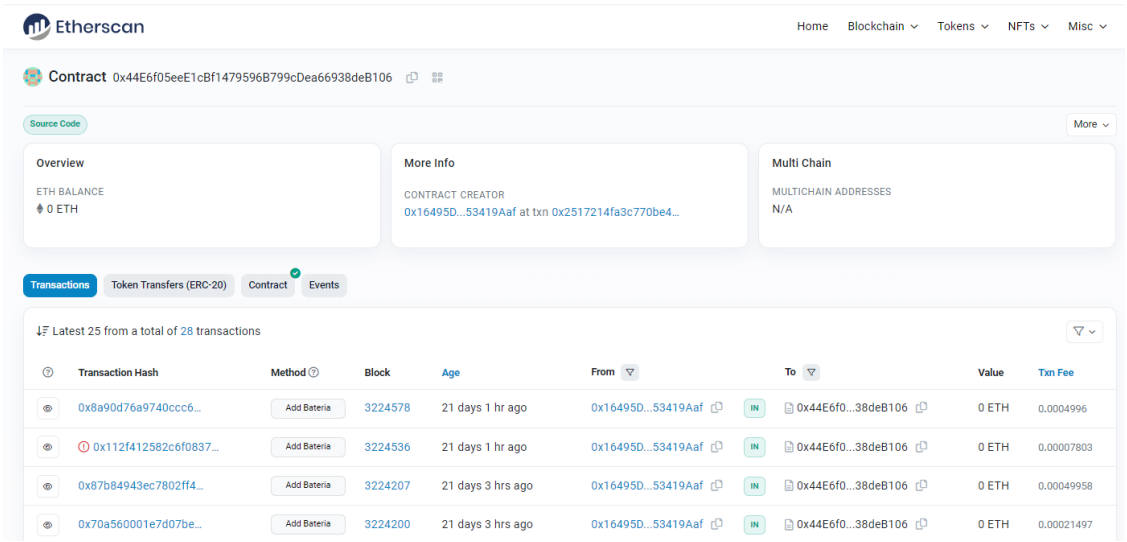
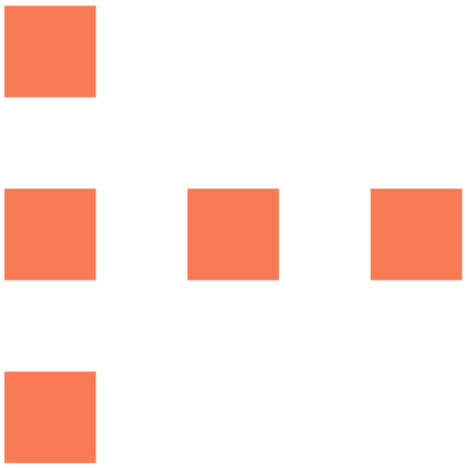


Figure 8. Example 4 of blockchain applications to share information about battery manufacturing process.



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