

Meet the SPINMATE Partners!



Introducing The Catalonia Institute for Energy Research (IREC): a publicly funded institution of approximately 160 people created in 2008 based in Barcelona and Tarragona that conducts research and promotes innovation over a wide range of energy related science and technology fields. IREC contributes to sustainability via development of new technological solutions, promotion of scientific and technological know-how related to sustainable energy and its efficient use as well as transfer of solutions and expertise to market actors. Activities include national and international projects as well as direct cooperation with leading industrial partners.

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Hello Jordi Jacas and Marc Nel-lo! Thank you for this opportunity to meet you and talk about SPINMATE. To kick-off, could you give us, in your own words, a short introduction to IREC, and your role there?

IREC is a research institute on energies located in Barcelona, Spain. IREC has spent many years promoting the development of new technologies and looking for the transformation of the actual energetic models. IREC'S research focuses on three main topics: energy and the environment, intelligent management of energy, and energy storage.

Here at IREC, both of us are researchers in the Energy Storage, Harvesting, and Catalysis group. We focus our research on battery technology, being able to contribute with our know-how in this field to the development of the SPINMATE project. Our primary role in this project is the physicochemical and electrochemical characterization of the cathode active material for the next generation of solid-state batteries (SSB) for electric vehicles (EV). IREC will be part of the benchmarking and optimization processes to select the better-performing Ni-rich layered oxide in this context. In such a feat, different thermally treated materials will be considered and even slight modifications of its formulation by Nb-doping will be added to the equation.

To someone reading this who is still not familiar with SPINMATE, how would you describe it in simple terms, and how do you distinguish it from other projects or initiatives?

SPINMATE project's main challenge is reaching the first milestone towards the large-scale manufacturing of the next generation of solid-state battery (SSB) cells. SPINMATE innovations related to processing and manufacturing will contribute to the sustainable and competitive large-scale production of SSBs, the reduction of the carbon footprint, and the enhancement of safety along the entire value chain. In the frame of the SPINMATE project, IREC together with Cerpotech and Cidetec partners, will optimize Nb-doped Ni-rich layered oxides NMC8₁₁ for the cathode processing and upscaling battery cells application. This material is currently being investigated as an active material for generation 3b Li-ion batteries. In SPINMATE, we will investigate its technological viability for SSB cells.

SPINMATE project starts with development and optimisation of cell components from 1 Ah to 10 Ah. IREC will take a key role on the raw material optimisation particularly with the optimisation/upscaling of high-capacity Ni-rich layered oxide active material. Could you tell us more about this process, and which will be the main challenges?

In this process, we are working directly with Cerpotech and Cidetec. The first is responsible for synthesizing and sintering the cathode-active materials. Cidetec is responsible for cathode processing. NMC8₁₁ based materials are produced via flame spray pyrolysis technology and must be posteriorly calcinated. Depending on these thermal conditions, the material's morphology and hence its electrochemical performance will be highly influenced. The effect of calcination temperatures and doping will be tested to achieve the best-performing cathode. One of the biggest challenges for the developed cathodes is to achieve a high-cycling capability, which is one of the main drawbacks of the selected Ni-rich layered oxide materials. On this matter, different reports related to such materials have shown that replacing some elements of its structure with a small amount of Nb atoms can significantly improve its cycling properties. However, in such a doping process, the adequate calcinating

temperature, or the suitable amount of doping agent, among other variables will have a key role in the final performance of the cathode.

IREC will be deeply involved on SSB cells assessment, which will mostly occur in the second half of the project. Which will be the main inputs from IREC on formation and testing procedures on monolayer cells to reach the best energy density and durability?

IREC participates in WP7 dedicated to SSB cell performances and ageing. Specifically, IREC will help characterize the monolayer cells at different conditions and investigate the effect of formation protocol on cell cycle life. IREC will also conduct post-mortem studies for the degraded studies aiming to understand the factors that limit the performance of SSB battery cells for improvement.

The evaluation of SSB cell's performance, durability, and safety will be conducted in the project second half. IREC takes a key role in this topic from the application of smart sensors and post-mortem analysis in degradation mechanisms. What can you share about the defects detection process to be used in SPINMATE?

IREC will use the FMEA approach to identify the cells' main fabrication defects at macroscopic and microscopic levels. This approach will include several techniques for the physicochemical characterization of fresh and degraded battery cell components, including impedance spectroscopy, a powerful technique to deconvolute the different impedance contributions in a battery cell.

IREC has deep know-how in material synthesis, characterization and performance optimisation, and electrode formulation, fabrication, and testing. At which level IREC will scale up its know-how and expertise within SPINMATE?

Within the SPINMATE activities, IREC will mature its know-how towards the fabrication and development of solid-state electrodes, especially Ni-rich cathodes, and the development of low-resistance solid-solid interfaces with the solid electrolyte.

What are you personally most enthusiastic about achieving during SPINMATE?

We believe the SPINMATE project is a great opportunity to set some bases for the next generation of SSB batteries in the EV industry. At IREC we are very excited to be able to work on the development of such an important battery component as it is the cathode. We are very motivated to look forward to the best electrochemical cathode candidate, while at the same time increasing our knowledge and expertise in such a relevant area. We hope to contribute to accomplishing better-performing batteries that may power up your future electric vehicle.

Certainly, there will be readers interested to meet you and discuss your experience in SPINMATE. Which events will be possible to meet IREC in the upcoming months?

We are currently considering different options, but the most appealing one for the moment is the 18th European Conference on Solid State Chemistry (ECSSC 2023) which will take place from the 9th to the 12th of July in Prague. In such an event, we will bring our latest breakthroughs related to the solid-state chemistry of our Ni-rich layered oxide cathode materials. Another meeting in which you will be very likely to find us is the Battery Innovation Days, which although a date and place are still not decided, will probably be held in

November in Brussels. Such a meeting will bring a great opportunity to exchange views on the strategic approaches to deploying the developed technologies and assess future R&I needs for a more competitive and sustainable European battery future.

**Jordi Jacas**

Scientific researcher

**Marc Nel-lo**

Postdoctoral researcher



INOVA+ – responsible for implementing the communication and dissemination activities in SPINMATE – conducted a series of interviews to the SPINMATE partners. If you would like to know more about the project partners, visit our online channels.

SPINMATE Website: www.spinmate.eu

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