extended

Next generation of multifunctional, modular and scalable solid state batteries system

NEWSLETTER

ISSUES NO.5 | 2026





ABOUT THE PROJECT

EXTENDED, a Horizon Europe project, is a collaborative effort bringing together 19 partners from 10 EU countries! Our mission is to design, develop, and validate the next-generation battery pack systems that will drive the mass-market adoption of electric vehicles and applications.



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MILESTONE MOMENTS

FIFTH EDITION

ROAD TRANSPORT RESEARCH CONFERENCE

FEBRUARY 2026







The EXTENDED team had the pleasure of taking part in the **Road Transport Research (RTR) Conference**, a prestigious event showcasing the latest results of EU-funded and Horizon Europe projects. From 10 to 12 February more than 1000 participants joined to listen to the presentations of a total of 92 projects, and to discuss the expected impacts and next steps in road transport research.

Bruno Rodrigues, project coordinator, was in charge of sharing our results with the audience at the Parallel Session entitled "*Next Generation Battery Systems for Road Transport and Mobility Applications*". Other speakers included Jeremy Warren, project coordinator of the TEMPEST Project, and Lisa-lou Gracia, project coordinator of the VERSAPRINT EU project, while the session was guided by Bozorg Khanbaei (Batteries European Partnership Association) and Martha Gialampouki (European Climate, Infrastructure and Environment Executive Agency).

The presentations showcased recent progress in battery pack architecture, materials development and system integration, with a focus on increasing energy density, reducing overall weight and strengthening safety performance, while also supporting circular design principles. The projects presented illustrated how system-level innovations, such as modular pack configurations, advanced sensing technologies and improved material solutions, can enable safer, lighter and more efficient battery systems for road transport and wider mobility applications.

Watch the full recording here

MILESTONE MOMENTS

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EU-INGENIOUS CLUSTER WEBINAR ON DESIGN OPTIMISATION

MARCH 2026

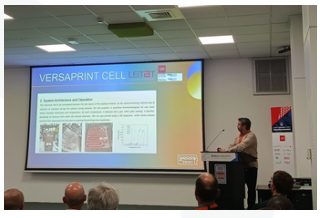


Carlos Micó Reche (Universitat Politècnica de València) was featured as a speaker in the session *Modeling & Simulation Approaches for Battery Pack Design Optimization"* as a part of the **Webinar on Optimizing Battery Pack Design with Advanced Modeling & Simulation**, held on March 24th.

Based on experience with EXTENDED, it was highlighted that electro-thermal models and thermal degradation approaches help predict heat generation, internal resistance, and gas combustion risks, while being validated through both simulations and real-world experimental tests. The use of 1D and 3D modelling techniques for battery modules and packs optimizes design and significantly enhances both safety and performance in battery technology.

VERSAPRINT INDUSTRIAL WORKSHOP







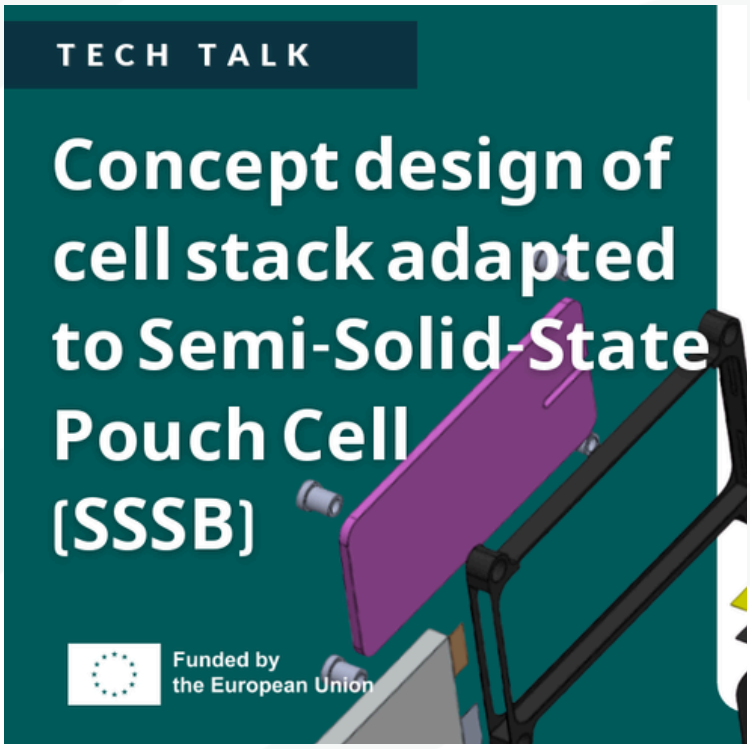
APRIL 2026

The VERSAPRINT EU team organised a collaborative workshop on versatile printed battery solutions for electrified mobility, inviting EXTENDED to contribute insights on **European research synergies**. During the session, **Bruno Rodrigues, joined by Stéphane Chevillard from BATSS EU**, addressed the transition from mid-stage technologies at TRL5 towards the industrial deployment of advanced battery systems. The discussion explored how deployment bottlenecks, cross-value-chain coordination, TRL progression, industrial uptake and social readiness are all interconnected in supporting the commercial adoption of emerging battery technologies.

MILESTONE MOMENTS

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DEVELOPMENTS ON THE CREATION OF A BATTERY CELL MODEL



APRIL 2026

As a part of the **Tech Talk** series, the **Univeristat Politècnica de València** has shared a battery cell model they have been developing for the virtual evaluation of thermal behaviour.

The proposed solutions aim to prevent or minimise battery thermal runaway and maximise efficiency, which will be tested. The new proposal for improvements in the BTMS along with a strategy to control the cell temperatures, includes the thermochemical and thermophysical properties of the cells, the design of the intramodular battery thermal management solution, the selection of BTMS components, the design of the BTMS control strategy, and the numerical evaluation of the package's safety.

ADVANCED BATTERY POWER CONFERENCE PRESENTATION

APRIL 2026

The results of the article elaborated by **Basit Jimoh, Christina Schieber, Dr. Yash Kotak, Hans-Georg Schweiger** from CARISSIMA, Technische Hochschule Ingolstadt in collaboration with **Çağla Odabaşı Özer, PhD**, from Siro Energy were presented last April at the **Advanced Battery Power Conference**. This work, entitled "*Thermal runaway in large format semi-solid-state cells: Analysis of abuse test results and machine-learing-based core temperature prediction*", was featured in the **Elsevier Journal of Energy Storage**. It shares findings regarding safety behaviour of semi-solid-state cells and their potential implications for safer battery module/pack design.



MILESTONE MOMENTS

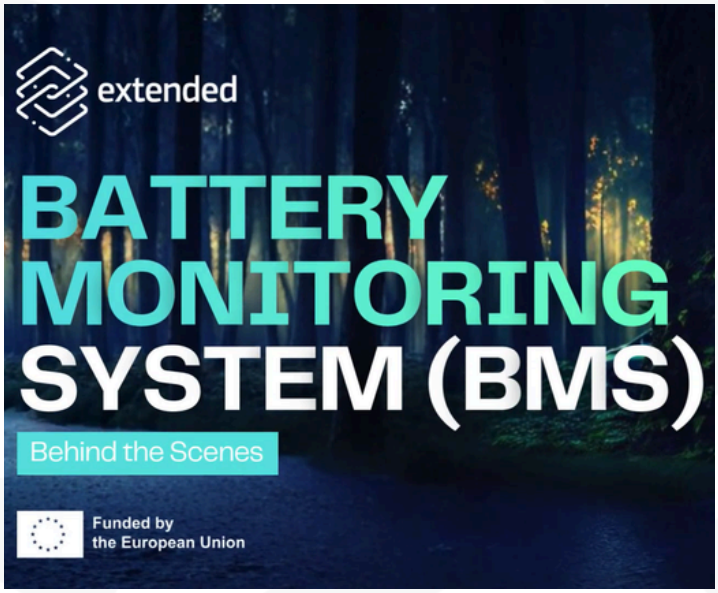
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BATTERY MONITORING SYSTEM BEHIND THE SCENES VIDEO

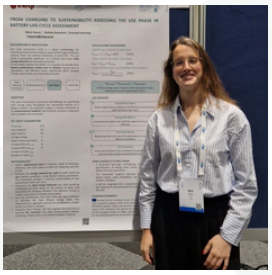
MAY 2026

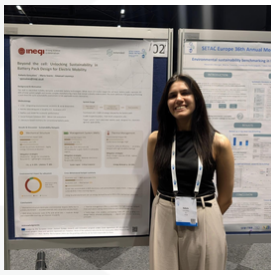
The latest video in the **Behind the Scenes** series is now available on **YouTube**, offering an inside look at how a Battery Monitoring System operates and supports the accurate management of battery performance.

The video presents how the CEA cell holder and infrared communication system work together to enable real-time synchronisation across the battery cells. This allows voltage and current measurements to be precisely aligned in time, ensuring that data from each cell is captured with high accuracy. By continuously exchanging information between nodes, the system uses a clock signal to maintain consistent timing for every measurement.



Watch the video here







SETAC 36TH ANNUAL MEETING

MAY 2026

The EXTENDED Project was represented by **Rafaela Gonçalves** and **Maria Soares**, from INEGI, at the **Society of Environmental Toxicology and Chemistry (SETAC)** 36th Annual Meeting, held from 17 to 21 May 2026 in Maastricht, the Netherlands. Their contributions focused on sustainable approaches to battery design, use and life cycle assessment for electric mobility.

The presentation showcased the project's research on sustainability-driven battery pack design and methodologies to assess the environmental impacts of battery use, focusing on life cycle sustainability, performance degradation, and the influence of materials, electronics, and thermal systems, while supporting more realistic estimations of energy consumption and improved decision-making for more sustainable battery design.

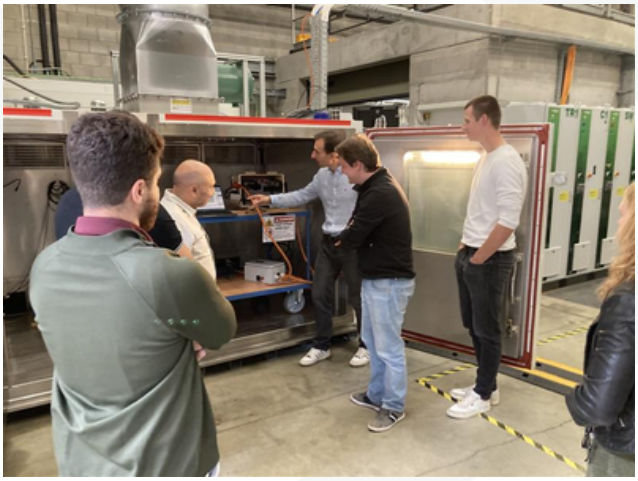
MILESTONE MOMENTS

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TECHNICAL ON-SITE MEETING IN BELGIUM

JUNE 2026

On 8–9 June, project partners came together at **Flanders Make** in **Lommel, Belgium,** for technical discussions, laboratory activities, and planning.



Due to the highly technical and hands-on nature of the workshop, part of the discussions took place directly in the laboratory environment. This allowed the EXTENDED consortium participants to address practical aspects of the test setup, equipment, instrumentation, and commissioning activities in detail.



The meeting included technical presentations and discussions on the characteristics of the different modules, including cell and battery features, the Master BMS and Slave BMS, as well as test setup, required equipment, instrumentation, commissioning activities, signal processing, test planning and next steps. Participants had the opportunity to visit the Flanders Make facilities, including a laboratory visit, supporting further exchange around the project's technical work and upcoming activities. A dedicated communication and dissemination session was also held, coordinated by INOVA+ and TECHConcepts, focusing on how to share project progress and results with relevant stakeholders.



The meeting provided an important opportunity for partners to align on technical requirements, clarify measurement and logging parameters, and agree on the next actions for the testing phase. By combining technical presentations, laboratory-based discussions, and collaborative planning, the workshop contributed to strengthening coordination between the partners and supporting the continued progress of the project.

VOICES OF IMPACT

FIFTH EDITION

In this edition, Flanders Make selected the key figure to be interviewed.
We are proud to feature Dr. Meisam Babaie from the School of Mechanical Engineering at the University of Leeds.

1. How do testing strategies need to evolve to accurately validate the performance, safety, and degradation of semi solid and solid-state batteries compared to conventional Li-ion batteries?

In terms of performance testing, mechanical/pressure testing is becoming more important. Solid electrolytes require external physical pressure to maintain contact between layers. Test protocols now need to specify and control stack pressure as rigorously as temperature or C-rate, and report performance across a pressure range. Degradation mechanisms will also require different diagnostics. Liquid-electrolyte Li-ion degrades mainly through SEI growth, electrolyte decomposition, and lithium plating. Solid-state batteries add interfacial delamination and void/contact-loss at the solid-solid interface and chemical/electrochemical instability at electrode-electrolyte interfaces (especially sulfide electrolytes reacting with lithium metal or cathode materials). Also, lithium filament/dendrite penetration through the solid electrolyte along grain boundaries which is different from from dendrite growth in liquid electrolyte, cause internal shorts without obvious external warning signs. This means EIS (electrochemical impedance spectroscopy) needs to be paired with X-ray CT, synchrotron imaging, or acoustic emission monitoring to actually see where contact loss or void formation is happening, rather than inferring it from capacity fade curves alone.

For the thermal/safety testing, current abuse testing (nail penetration, crush, overcharge, etc.) was designed around the failure physics of flammable liquid electrolytes and the runaway cascade they enable. Solid electrolytes are often framed as inherently safer but they are not immune to failure. Thermal runaway pathways differ enough that you can't just assume a pass on legacy tests means the cell is safe. So, safety testing needs to extend beyond thermal and electrical abuse to include controlled mechanical loading combined with cycling to evaluate crack formation, interface debonding, and short-circuit initiation. Furthermore, testing strategy probably needs cell-chemistry-specific failure-mode analysis rather than a single abuse-test checklist applied across all chemistries. For the pack kevel, test standards must also evolve to reflect solid-state mechanical sensitivities, rather than relying on legacy pack-level vibration and thermal tests.

2. What new challenges arise when integrating new battery cell technologies into modules and packs, particularly in terms of mechanical design, interfaces, and reliability?

Solid-state and semi-solid cells often need specific stack pressures and are more brittle, so pack designs must deliver uniform compression while avoiding stress concentrations during vibration or crash. Mounting and isolation systems must balance structural rigidity with compliant layers or stress buffers to avoid cracking solid electrolytes or interfaces under dynamic loads. High stack pressure demands complex mechanical designs and complicates flexible battery and large-format cell development; maintaining uniform pressure at the module level over long-term operation is technically challenging and costly. These new chemistries and architectures also change how heat is generated and transported, impacting both thermal design and reliability. New cell formats often require different cooling strategies and can be more sensitive to thermal gradients that induce mechanical stresses and uneven ageing. Furthermore, semi solid and solid-state cells may exhibit different thermal runaway dynamics (e.g. less volatile electrolyte but higher energy density), so module spacing, barriers, and pack venting must be re-designed to prevent propagation. Pack integration challenges also arise from manufacturing constraints and tolerance stacks associated with new cells and structural architectures. New cells with precise pressure windows and brittle components, demand tighter geometric tolerances in module frames, compression plates, and pack housings, increasing complexity and cost.

3. How can emerging validation approaches such as Hardware-in-the-Loop, digital twins, and virtual testing transform battery development by reducing testing time while maintaining high reliability and safety standards?

Emerging validation approaches like Hardware-in-the-Loop (HIL), digital twins, and virtual testing can compress battery development timelines by shifting much of the exploration and safety validation into high-fidelity simulated environments, while still keeping real hardware where it matters to maintain reliability and safety. For example, HIL can expose batteries and BMS algorithms to aggressive drive cycles, grid events, and fault conditions that would be difficult or dangerous to reproduce with full vehicles or prototypes. This reduces the need for long, expensive road or field tests, while still validating responses to over-current, over-voltage, temperature excursions, and cell imbalance in a controlled environment. Furthermore, a battery digital twin can simulate years of usage for different driving styles, climates, fast-charge profiles, within days, providing early insight into expected degradation and safety performance for specific designs and use cases. This supports more precise safety designs and operational constraints, enabling aggressive usage (e.g. fast charging, high power, extreme weather). On the other hand, virtual testing can use high-fidelity models (cell, pack, vehicle) to run large numbers of synthetic test scenarios including drive cycles, environmental conditions and abuse events, before or in parallel with hardware testing. This is shortening the design phase and test campaigns while still achieving high confidence in performance and safety across the operating conditions.

MEET DR. MEISAM BABAIE



@Meisam Babaie

Dr. Meisam Babaie is currently a **Lecturer (Assistant Professor) in the School of Mechanical Engineering at the University of Leeds.** He has several years of experience across both academia and various industries, including automotive manufacturing. He has also contributed to different academic institutions and laboratories, including Queensland University of Technology in Australia, Gunma University in Japan, and the Automotive and Autonomous Vehicle Technology Laboratory in the UK. His research interests in transport electrification include powertrain design, multi-scale and multi-physics modelling of battery cells and systems, and battery thermal management and safety for both light- and heavy-duty applications, some of which are funded by different funding bodies.

NAVIGATING EXCELLENCE

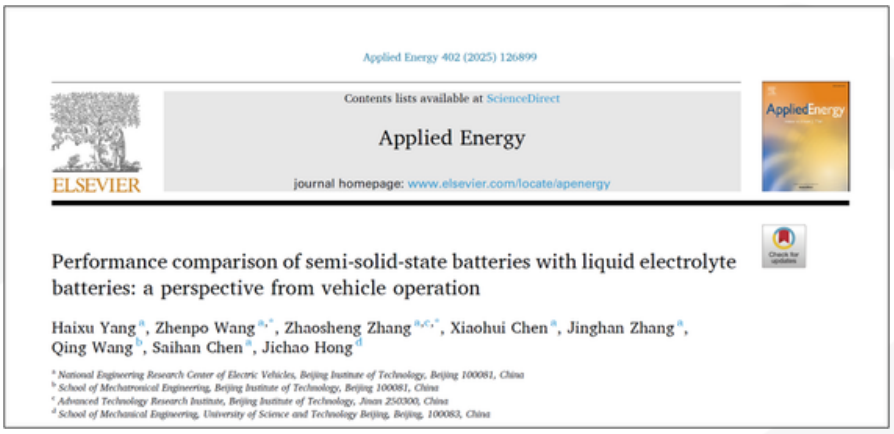
FIFTH EDITION

TOP PICKS FROM EXTENDED PARTNERS



Mohsen Akbarzadeh is a business developer and battery systems specialist at Flanders Make, with a PhD in battery system engineering. He has extensive experience in the development and implementation of battery systems for diverse applications. Over the course of his career, he has contributed to numerous European projects in the field of road transport, maritime transport and stationary energy storage applications. He is involved in WP7 of EXTENDED project, where Flanders Make leads the testing and validation of the battery pack.

In this fifth edition of the **EXTENDED** newsletter, we take great pride in presenting **Mohsen Akbarzadeh's** top pick scientific paper



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Performance comparison of semi-solid-state batteries with liquid electrolyte batteries: a perspective from vehicle operation

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"I selected this paper because it provides a real-world, vehicle-operation-based comparison between semi solid-state and conventional liquid electrolyte batteries, going beyond lab-scale evaluations. By using actual driving data, the study offers valuable insight into how these batteries behave in realistic conditions and helps reveal the current limitations of semi solid-state technology in practice. The study shows that semi solid-state batteries exhibit strong temperature-dependent behaviour, with lower internal resistance at high temperatures but significantly higher resistance at low temperatures, highlighting a key challenge for practical deployment. While semi solid-state batteries demonstrate better overall cell consistency, they also exhibit greater variability in capacity degradation and weaker performance of extreme cells, which can impact pack-level reliability. Additionally, the incremental capacity analysis points to more stable electrode/electrolyte interfaces, but also suggests less uniform aging behaviour across cells. Overall, the paper not only highlights the performance trade-offs and current shortcomings of semi solid-state batteries under real usage, but also provides important direction for future optimization in areas such as thermal behaviour, degradation control, and pack-level balancing, making it highly relevant for ongoing battery pack design and testing."

- Mohsen Akbarzadeh

The **EXTENDED** newsletter is released semi-annually with the primary goal of fostering awareness about our project and its results, shedding light on the transformative impact of battery development on eco-friendly transportation.

DIVE INTO OUR WORLD!

Stay informed about our project and the dynamic field of battery development.

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