2025

Insights from the AABC Europe 2025 Conference

CONFERENCE REPORT

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SIMMOL | Vlaanderenstraat 6/301, 2000 Antwerp, Belgium

Welcome

The AABC Europe conference was held 23-26 June in Mainz this year. We remember going to one of the first editions and it still is one of the most deep technical conferences. The show was once again held in Mainz, Germany, but we decided to attend it virtually. No running around from one hall to another or sitting in the back row, but a more immersive and focused experience from the home office. There's even an option to do online networking. The organization was flawless.

Overview of AABC Europe 2025

Each year, AABC Europe brings together a global audience of battery technologists and their key suppliers for a must-attend week of development trends, breakthrough technologies and predictions of the market for years to come. As European nations and international automotive OEMs invest in their commitment to vehicle electrification and eMobility, the 2025 event in Mainz will help propel that momentum forward, presenting unparalleled coverage of the research and development that helps drive outcomes and supports the next generation of electric vehicle batteries.

Here are just some of the OEMs and battery developers that presented in 2025.

Save the date for next year's edition: 18 – 21 May 2026

Key Trends & Innovations

In this report we'll touch on the presentations that we feel are most innovative grouped by the following categories.

- EV Cell Chemistry & Format Evolution
- Fast Charging Technologies
- Thermal Management
- Solid-State & Semi-Solid Trends
- Pack Architectures for BESS
- Recycling & Second-Life

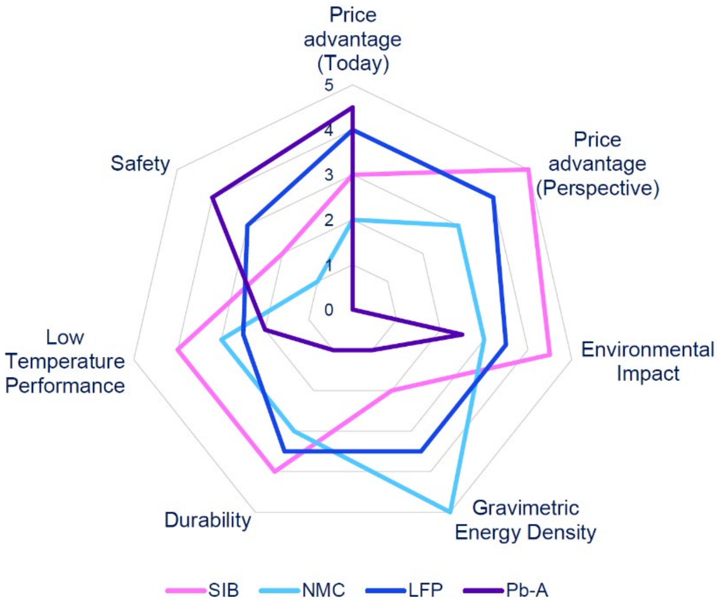
While AABC Europe primarily has an automotive focus, it's certainly wise for BESS players to keep an eye on the developments in the largest market for batteries, and decide which spillovers are relevant.

The conference started as usual with a day of tutorials, which we will not cover in this report.

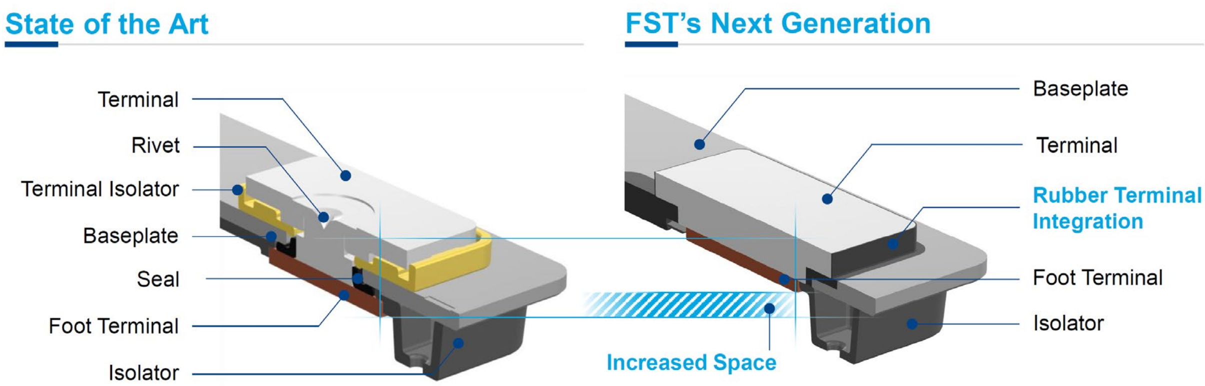
We've reviewed the 142 slide decks which were made available after the conference, and picked the most relevant for our customers.

EV Cell Chemistry & Format Evolution

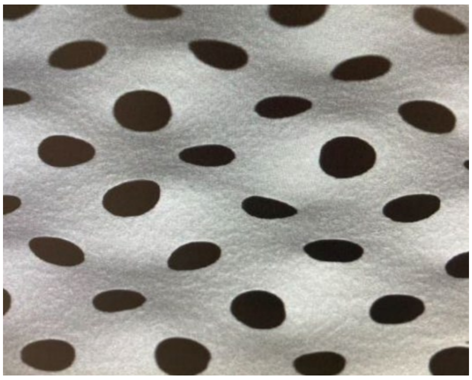
Sodium-Ion vs. Lithium-Ion: Advancing Low-Voltage Battery for Sustainable Automotive Applications – *Dr. Sébastien Sallard (IAV France)*: Introduces a 48V **sodium-ion** battery as an alternative to Li-ion for mild hybrids. The novel cell chemistry offers comparable performance to lithium iron phosphate (LFP) cells while dramatically reducing environmental impact (62% lower overall footprint). This approach addresses resource sustainability and cost, showing market promise for low-voltage EV systems by leveraging abundant sodium. The work aligns with future trends by improving supply chain resilience and lowering the carbon footprint of EV batteries.



Advanced Mechanical Components for Current & Future Cells – *Dr. Peter Kritzer (Freudenberg Sealing Technologies)*: Presents **innovative cell hardware** (terminals, caps, housings, and stack envelopes) that enhance cell safety and enable next-generation chemistries. Freudenberg developed custom cell caps and lateral housing designs that improve performance and could even facilitate **solid-state batteries** by providing mechanical support for new electrolytes. These engineering advancements in cell format (e.g. novel sealing, tabs, and enclosures) offer significant improvements in energy density, safety, and manufacturability, supporting the industry's shift toward high-energy and solid-state cells.

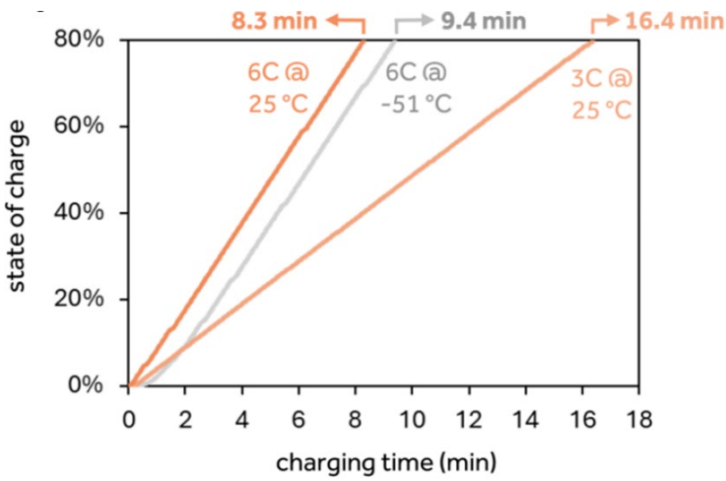


Surviving the Cost War: Innovation as the Key to Battery Manufacturing Success – *Boaz Mamo (Addionics Ltd.)*: Details a manufacturing innovation – Addionics' 3D **porous current collectors** – that boosts battery performance and lowers cost. By using a 3D-structured electrode (porous metal foil), they achieve stronger adhesion of active material and eliminate certain coating steps. This yields batteries with longer cycle life and higher energy density (92% capacity retention after 900 cycles vs. 88% at 700 cycles for standard cells). The approach is highly novel in cell design, improving both scientific understanding of electrode interfaces and offering a commercially viable path to cheaper, longer-lasting EV batteries. This reminded us somewhat of our lead-acid days of stretch metal electrodes.

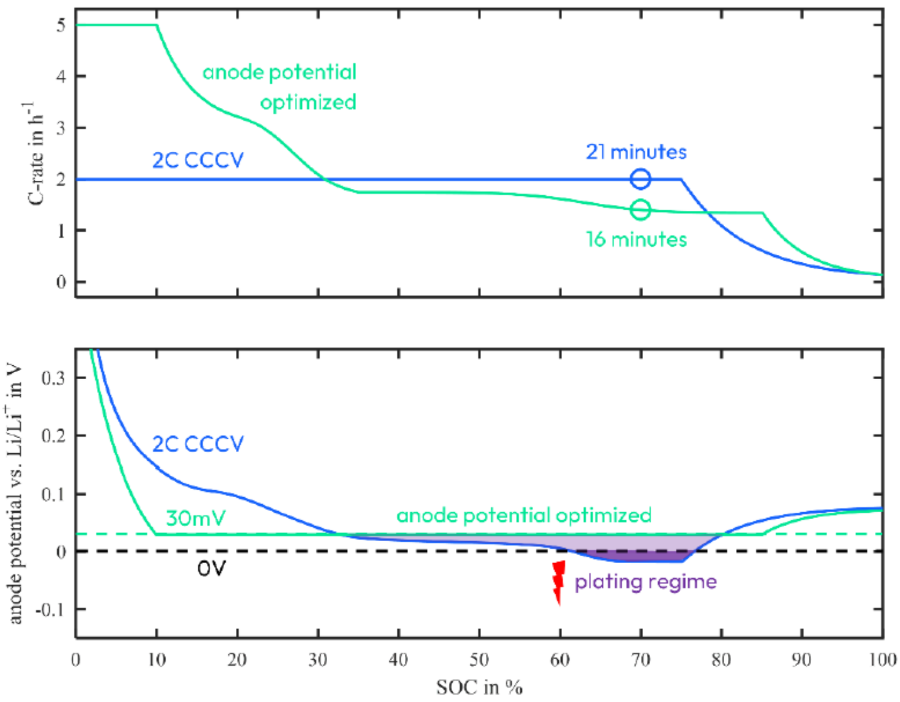


Fast Charging Technologies

Delivering Critical Power and Fast Charging in Cold Climates – *Brian McCarthy (FastLion Energy)*: Unveils a solution for **extreme-fast charging at subzero temperatures**. Using a standard Li-ion chemistry augmented by proprietary thermal management, FastLion demonstrated 6C charging (0–80% in ~10 minutes) at **–51 °C** on an 11 Ah LFP cell. This breakthrough addresses a major limitation: in cold weather, batteries typically cannot fast-charge without pre-heating. The novel approach maintains battery temperature during high-power charge, enabling reliable fast charging in Arctic conditions. This has significant market impact for EV adoption in cold regions and showcases deep scientific innovation in electrochemical kinetics and thermal control.



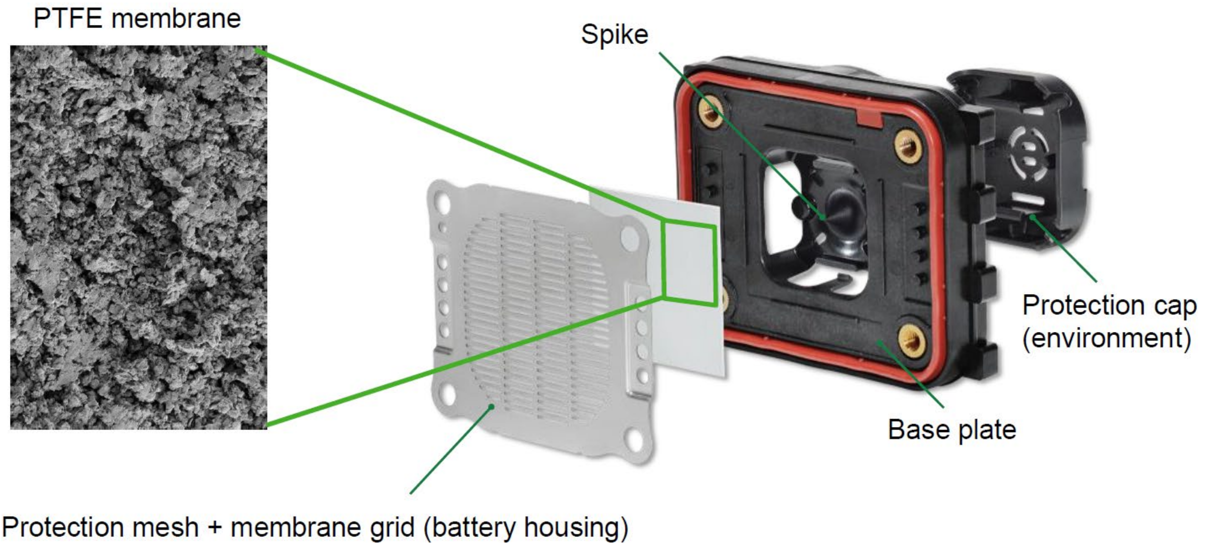
AI-Based Prediction of Anode Potential for Optimized Fast Charging – *Dr. Michael Baumann (TWAICE)*



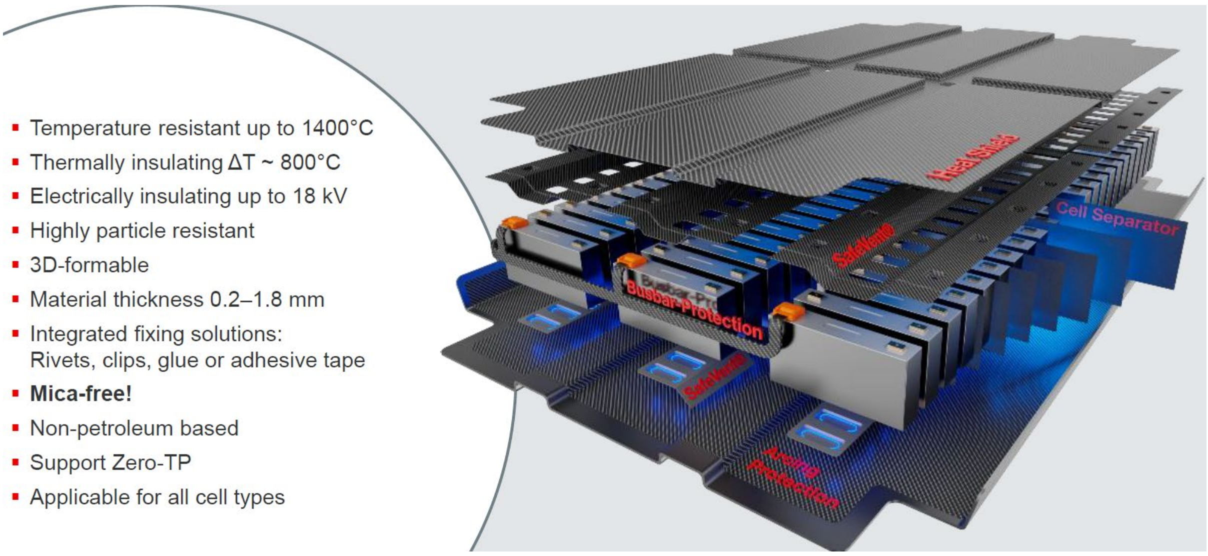
This innovative research introduces a predictive model powered by **artificial intelligence** (AI) that calculates the anode potential in real-time during fast charging events. By dynamically estimating the anode's electrochemical potential, the model precisely controls charge currents to avoid lithium plating and other degradation mechanisms. This approach significantly enhances battery safety, cycle life, and performance, enabling ultra-fast charging (10–15 minutes) without compromising battery health. With its sophisticated AI-driven algorithms trained on extensive datasets, the method offers substantial improvements in the reliability and lifetime of EV batteries, making it highly relevant to commercial deployment. It aligns perfectly with future trends of smart battery management systems (BMS) and is poised to reshape the industry's approach to managing rapid charging demands.

Thermal Management

Advancing Automotive Battery-Pack Safety with Innovative Venting Units – *Dr. Michael Harenbrock et al. (Mann+Hummel)*: Describes a new **battery venting system** that enhances safety during thermal runaway. The team developed venting units with special membranes and filters that relieve pressure while **capturing ejecta and toxic gases** when a cell fails. This innovation prevents flame propagation and reduces the risk of fire or explosion, aligning with upcoming regulations requiring no fire for extended periods. With features like metal grids and glass-fiber media to filter out particles, the venting solution significantly improves passenger safety and is commercially relevant for meeting strict battery safety standards in EVs and energy storage systems.



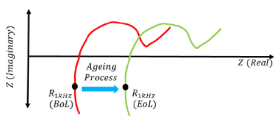
Engineered Components for Thermoelectrical Insulation – Increasing Battery Safety to Zero-TP – *Marius Dalinger (Oerlikon)*: Introduces an **insulation system** to achieve "Zero Thermal Propagation" (Zero-TP) in EV packs. The approach uses advanced thermoelectric insulating materials between cells to prevent heat and fire from spreading in a runaway event. The insulation also stops electrical arcing from igniting vented gases and resists burn-through of the battery enclosure. By effectively localizing thermal incidents with no propagation to neighboring cells, this technology addresses new legal safety requirements and represents a deep engineering solution. It is highly aligned with future safety trends, aiming for EV packs that contain failures without causing vehicle fires (a critical market need).



Immersion-Cooled Battery Technology and High-Speed BMS – *Nicolas Jäckel (LION Smart GmbH)*: Presents a **direct immersion cooling** architecture for battery packs coupled with an advanced battery management system. Cells are submerged in a dielectric fluid, yielding best-in-class thermal control (uniform temperatures and <5 K spread) even under fast charge/discharge. Uniquely, each cell has an individual BMS with impedance spectroscopy, enabling real-time health monitoring and early detection of events like lithium plating or thermal runaway. This pack architecture greatly increases safety and performance – allowing higher C-rates and longer life – and is near commercialization (proven in designs for trucks, buses, and stationary storage). It exemplifies a trend toward aggressive thermal management and smart packs for ultra-fast charging and high-power applications.

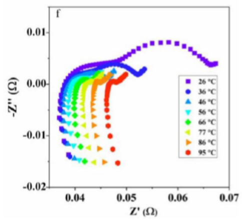
State of Health Calculation

- Direct measurement of the impedance at a defined frequency and more precise determination of the internal resistance
- **Advantage**: Direct measurement on the cell without external influences



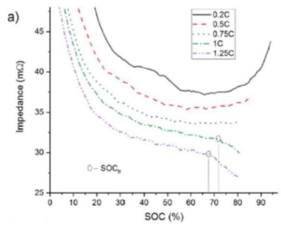
Thermal Runaway Detection

- Continuous monitoring of the impedance and immediate detection in the event of increased internal cell temperature
- **Advantage**: Faster detection, as the heat does not have to diffuse through the cell (and possibly busbar) first



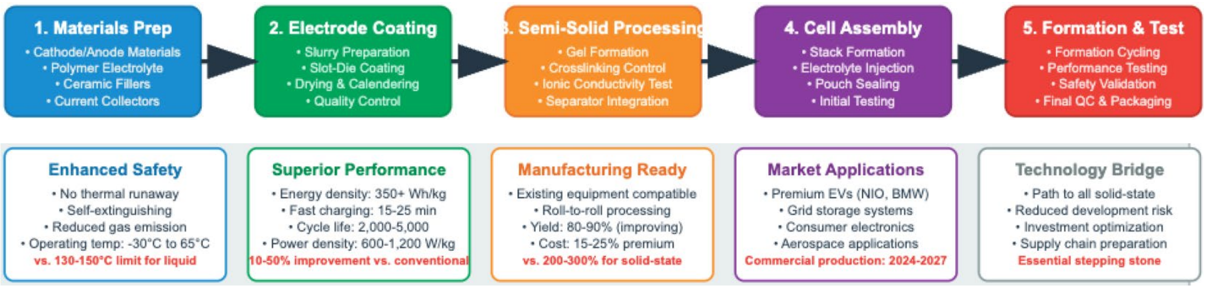
Lithium Plating Detection

- Continuous monitoring of the impedance during charging
- **Advantage**: If there are deviations in the impedance during charging, the charging power is immediately reduced → Plating is prevented



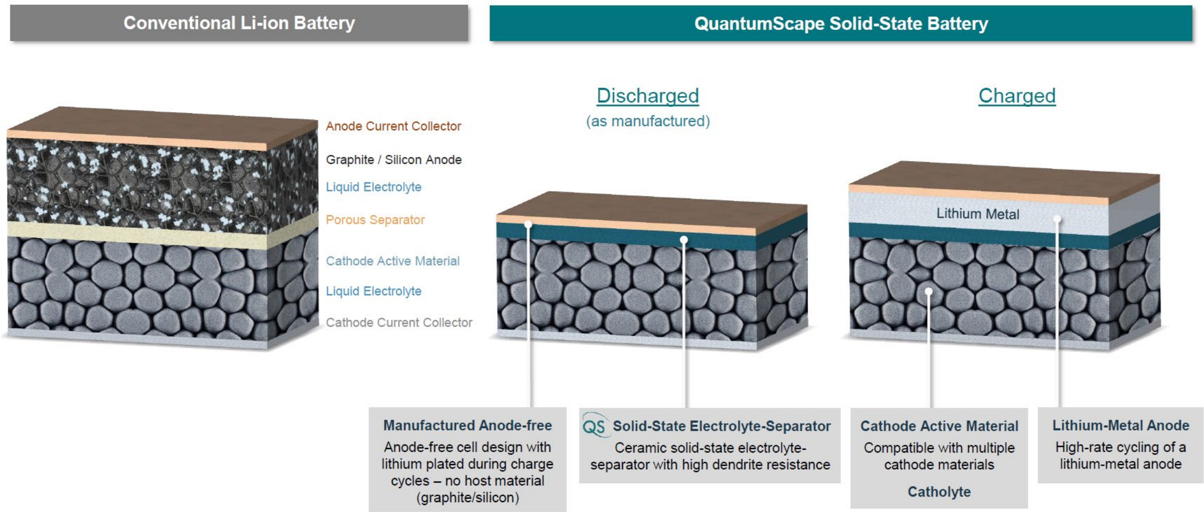
Solid-State & Semi-Solid Trends

Li-ion Battery from Semi-Solid to All-Solid-State: Technology Roadmap, Progress, and Commercial Transition – *Dr. Timothy Lin (Solid Energies Inc.)*: Outlines a transitional **semi-solid electrolyte** approach as a bridge to full solid-state batteries. This roadmap details a hybrid design using a gel-like electrolyte (10–50% liquid) that improves safety and energy density over conventional Li-ion, while being more manufacturable than 100% solid cells. The semi-solid technology offers enhanced low-temperature performance and fast charging (2–4C) without the need for external pressure, addressing key solid-state challenges. Dr. Lin shows that this innovation is already reaching commercialization, with multi-layer pouch cell prototypes and a clear scale-up path. This work is novel in bridging current Li-ion and future solid-state, with significant market impact as it can be produced on adapted existing production lines.

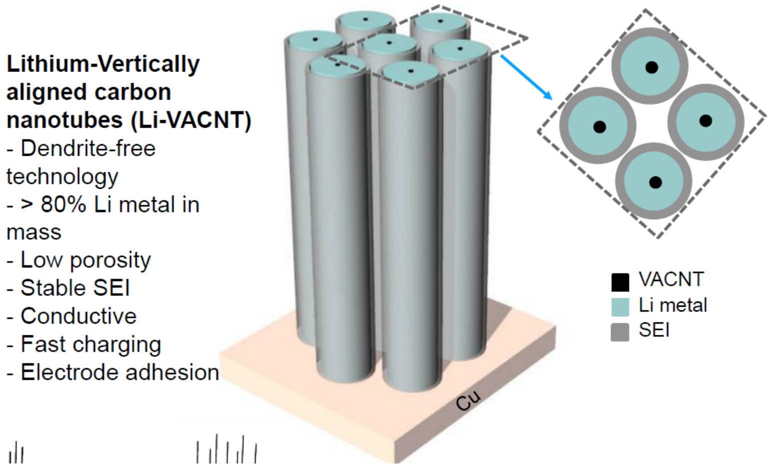


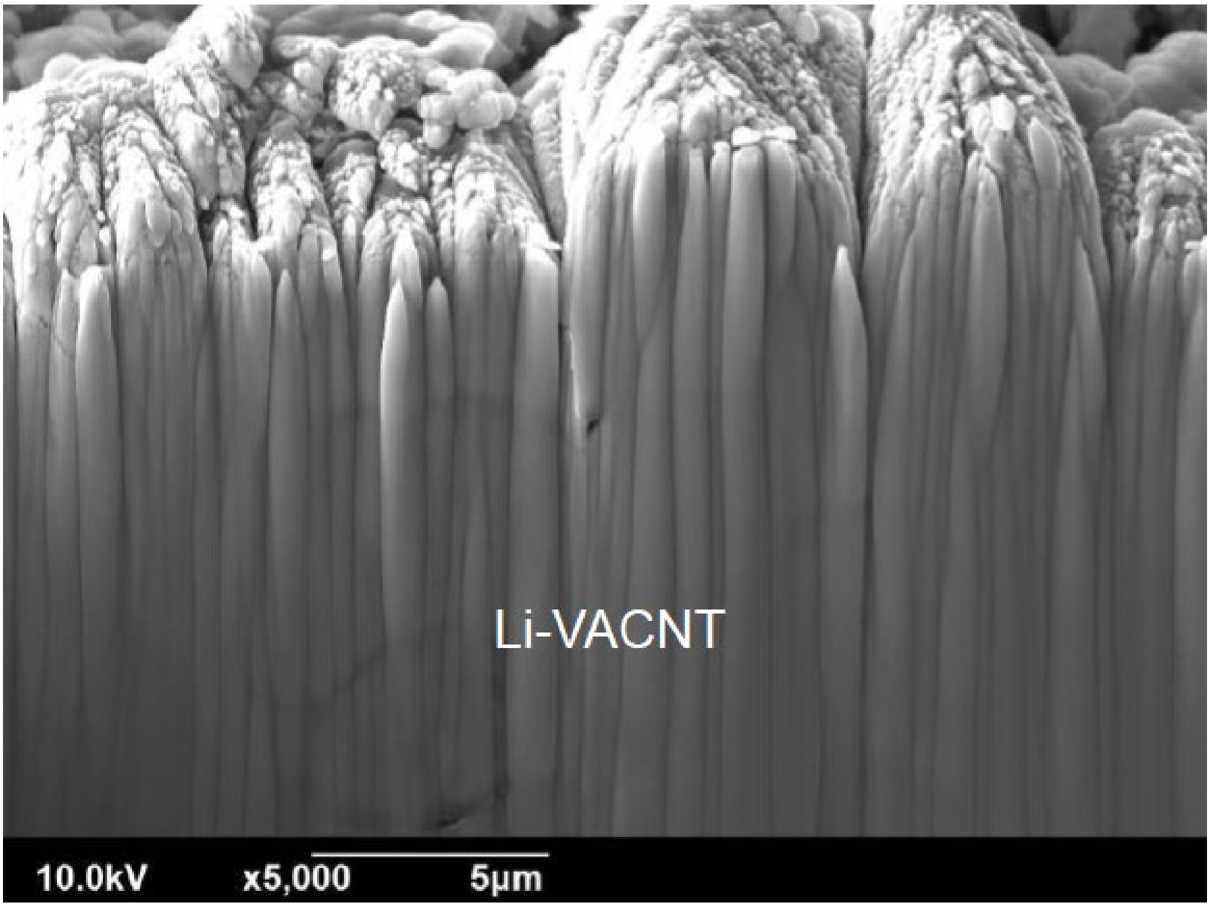
Industrial-leading technology in solid-state Li-ion battery.	SOLID ENERGIES.	QuantumScape	Solid Power	SAMSUNG	OEM NEEDS
More layers: Higher capacity & lower cost	40 Layers (15Ah)	16 Layers	16 Layers (2Ah)	2 Layers	30+ Layers
No external pressure needed: Simplify package/lower costs	<1 ATM	>3 ATM	Unknown	20 ATM	<1 ATM
Fast charging/discharging	5mA/cm^2 (~5C)	3mA/cm^2	5mA/cm^2	>3mA/cm^2	Up to 5m A/cm^2
Low temp. capability and wide operation temperature	-40 to 90°C	-20 - 80°C	20 - 45°C	>60°C	-20 - 50°C
High energy density	350-500Wh/kg	Unknown	350 Wh/kg	Unknown	>350Wh/kg

QuantumScape's Anode-Free Solid-State Battery – *Dr. Matthew Genovese (QuantumScape Corp.)*: Provides a progress update on QuantumScape's **lithium-metal solid-state** battery. The cell uses a ceramic solid electrolyte separator and an *anode-free* design (lithium is plated on charge). This architecture yields exceptionally high energy density and enables **15-minute quick charging** while maintaining safety (no flammable liquid, robust dendrite resistance). The presenter highlighted recent results: e.g. 800+ cycles with ~95% capacity retention and operation from –30 °C to 60 °C at low pressure. QuantumScape's work is a deep scientific contribution, resolving issues like interface stability and manufacturing scale-up. It is highly aligned with future EV needs, promising a commercially viable solid-state battery with far superior performance to today's Li-ion.



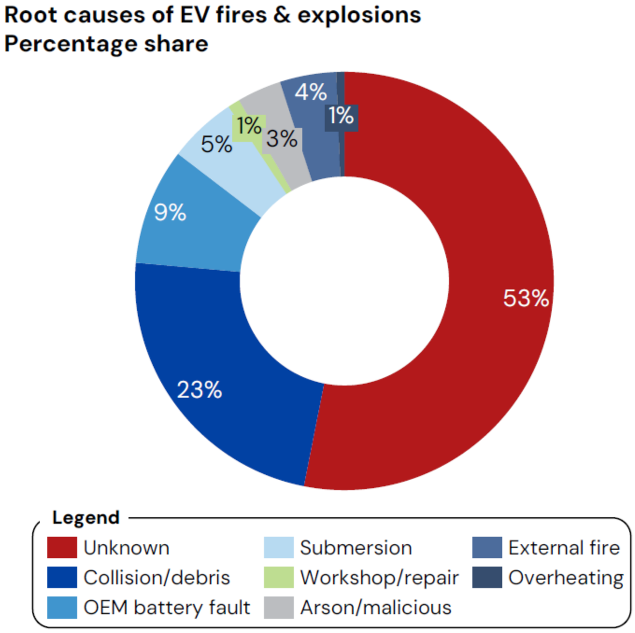
Lithium Sulfur – A Different Approach – *Michael Liedtke & Dr. Franz-Josef Krüger (Zeta Energy)*: Showcases an innovative **Li–S battery** chemistry using a proprietary lithium-metal anode structure. Zeta's design grows lithium on a forest of vertically aligned carbon nanotubes (VACNT), creating a lightweight, porous lithium anode that is **dendrite-free** with a stable SEI. Coupled with a sulfur–carbon composite cathode, this cell achieves high specific energy with improved safety and cycle life for Li–S technology. The novel VACNT-based anode addresses longstanding Li–S issues (like shuttle effect and lithium dendrites) by securing most of the lithium within the nanotube scaffold. While still in development, the approach has strong future potential: it uses low-cost materials (sulfur, no nickel or cobalt) and could deliver a major leap in energy density for electric vehicles or aviation. Its alignment with future trends is clear as the industry explores beyond-Li-ion chemistries.





Pack Architectures for BESS

Navigating Battery Industry Risks – *Dr. Simon Engelke (Battery Associates)*: Provides a comprehensive analysis of risks affecting battery packs and supply chains, with implications for stationary storage design. Engelke highlights that more than **50% of BESS failure root causes** remain unidentified in current deployments, underscoring the need for better diagnostics and design standards. The talk also examines new safety regulations (e.g. China's 2025 rule requiring EV batteries to not ignite or explode for 2 hours after thermal runaway) and recommends engineering and monitoring solutions to meet these stringent criteria. While not a hardware innovation per se, this insight is **innovative in practice**, guiding how future BESS packs should be architected for higher safety and reliability. The depth of analysis (spanning supply chain, production, and operational risks) and its alignment with emerging safety trends make it a crucial contribution to BESS pack development.



Recycling & Second-Life

Evolving Regulatory Landscape for Batteries – *Dr. Maximilian Voland (VARTA AG)*: Reviews new and forthcoming **battery regulations** that will drive innovation in recycling and second-life. This presentation highlighted legislation such as the EU Battery Regulation, which mandates high recycling efficiencies and the use of recycled content, as well as frameworks for second-life usage rights. It also covered safety standards like UN R100 and China's GB 38031-2025 that enforce strict thermal propagation resistance and monitoring in packs. While not a technical paper, it is innovative in mapping how policy is shaping technical requirements – for example, designers must now ensure batteries can be easily recycled and repurposed, and BMS must support state-of-health reporting for second-life. The market impact is immediate: companies are adjusting pack architectures and recycling processes to comply. Dr. Voland's overview provides depth on future trends, ensuring that scientific advances in recycling & reuse align with and are accelerated by the regulatory environment.