

TROY TECHNICAL

ALL-SOLID-STATE BATTERIES

WEEKLY REPORT

September 19 - September 25, 2026 | Issue 2026-W38

**Interface stability, manufacturability, safety
and automotive qualification**

14

ANALYZED ARTICLES

10

PRIORITY THEMES

Issued 2026-09-25 | English edition | fixed approved cover artwork



All-Solid-State Batteries: the boundary moved from isolated claims to qualification evidence

14 English articles were reviewed independently from the Japanese edition. Ten themes are retained for management decisions.

SIGNAL 01 | ELECTROLYTE

Ion Energy: Polymer ASSB specs, 520Wh/kg and 6-min charge time

Ion Energy's Wuhan R&D and production base is now operational, moving its polymer all-solid-state batteries from testing to mass production.

SIGNAL 02 | ELECTRODE INTERFACE

Sulfide and LLZO: 2026 roadmap for all-solid-state electrolytes

A comprehensive review published in 'Discover Electrochemistry' details a roadmap for solid electrolyte materials critical to the commercialization of all-solid-state lithium batteries. The study by Mohan Jagan and S. P.

SIGNAL 03 | CELL PROCESS

CATL: All-solid-state battery production timeline for 2027

CATL aims for small-batch production of all-solid-state batteries by 2027, though current technology remains at TRL-4 (laboratory principle verification).

SIGNAL 04 | VALIDATION

NaCl Electrolytes: Al³⁺/O²⁻ co-doping for Na-ion battery stability

Researchers have developed an Al³⁺/O²⁻ co-doping strategy for NaCl-based solid electrolytes, achieving a high ionic conductivity of $2.7 \times 10^{-4} \text{ S cm}^{-1}$ at 30°C.

DECISION

Focus this week's management attention on interface stability, manufacturability, safety and automotive qualification. Move only when the linked evidence can be reproduced under your own operating conditions.

THREE MANAGEMENT MOVES

1. Buyers: compare cell evidence under practical loading, pressure, temperature and cycle conditions.
2. Suppliers: show powder, interface and process consistency together with scale and cost.
3. Executives: track loading, pressure, interface resistance, yield, safety, capacity and timing.

EVIDENCE DISCIPLINE

FACT states what the collected English source reports. BUSINESS READ and ACTION are editorial interpretations. UNKNOWN lists information that the source file does not establish. A linked article is not treated as independent confirmation of every claim.

Five numbers or evidence anchors that require conditions

520W A10	SOURCE-BOUND CONDITION Their proprietary 51Ah automotive solid-state battery boasts an energy density of 520Wh/kg, 6-minute ultra-fast charging, and a cycle life over 3,500 cycles.
80% A12	SOURCE-BOUND CONDITION Factorial's manufacturing process is compatible with approximately 80% of existing lithium-ion battery production equipment and uses a unique dry cathode process to reduce manufacturing costs and energy consumption.
P03 A13	SOURCE-BOUND CONDITION CATL aims for small-batch production of all-solid-state batteries by 2027, though current technology remains at TRL-4 (laboratory principle verification).
P04 A04	SOURCE-BOUND CONDITION Researchers have developed an Al³⁺/O²⁻ co-doping strategy for NaCl-based solid electrolytes, achieving a high ionic conductivity of 2.7×10^{-4} S cm⁻¹ at 30°C.
P05 A08	SOURCE-BOUND CONDITION An innovative quasi-dry sulfide film technology has made roll-to-roll manufacturing for all-solid-state batteries a reality.

HOW TO USE THESE NUMBERS

Each value is shown with the condition stated in the collected English article. Do not compare values across different test methods, device sizes, operating temperatures or commercial stages without normalizing those conditions.

Where the value chain moved

Each stage combines one leading theme and one supporting theme. The report treats handoffs as evidence transfers, not decorative arrows.

1

Electrolyte

P01/P06

Ion Energy's Wuhan R&D and production base is now operational, moving its polymer all-solid-state batteries from testing to.

2

Electrode interface

P02/P07

A comprehensive review published in 'Discover Electrochemistry' details a roadmap for solid electrolyte materials critical to.

3

Cell process

P03/P08

CATL aims for small-batch production of all-solid-state batteries by 2027, though current technology remains at TRL-4.

4

Validation

P04/P09

Researchers have developed an Al³⁺/O²⁻-co-doping strategy for NaCl-based solid electrolytes, achieving a high ionic.

5

Vehicle deployment

P05/P10

An innovative quasi-dry sulfide film technology has made roll-to-roll manufacturing for all-solid-state batteries a reality.

EVIDENCE REQUIRED AT EACH HANDOFF

Electrolyte to Electrode interface	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck loading, pressure, interface resistance, yield, safety, capacity and timing.
Electrode interface to Cell process	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck loading, pressure, interface resistance, yield, safety, capacity and timing.
Cell process to Validation	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck loading, pressure, interface resistance, yield, safety, capacity and timing.
Validation to Vehicle deployment	Transfer test conditions, acceptance criteria, failure data, owner and decision date. Recheck loading, pressure, interface resistance, yield, safety, capacity and timing.

COMMON CONTROL POINT

No theme moves to a commercial commitment until a named owner has reproduced the relevant evidence and documented loading, pressure, interface resistance, yield, safety, capacity and timing.

Priority map: maturity and next decision locus



REPRODUCIBLE POSITIONING RULE

Horizontal position uses five discrete stages: Research, Prototype, Joint evaluation, Product adoption and Scale. The vertical bands classify the next decision locus: Tech / process, System / adoption, or Business / rules (including supply systems).

Article-title cues take precedence; the overview is used only when the title is silent. These are categories, not impact ranks. Bubble diameter reflects the editorial score.

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P01

Ion Energy: Polymer ASSB specs, 520Wh/kg and 6-min charge time

A10 | Electrolyte | Scale-up

Date not stated

FACT

Ion Energy's Wuhan R&D and production base is now operational, moving its polymer all-solid-state batteries from testing to mass production. Their proprietary 51Ah automotive solid-state battery boasts an energy density of 520Wh/kg, 6-minute ultra-fast charging, and a cycle life over 3,500 cycles. The battery has successfully passed all GB38031-2025 national tests. Concurrently, Dongfeng Motor's 350Wh/kg solid-state battery mass production is delayed to Q4 2026, with a 0.2GWh pilot line currently running.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P01.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 21/25 | MATURITY 5/5 | DECISION LOCUS: SYSTEM / ADOPTION

P02

Sulfide and LLZO: 2026 roadmap for all-solid-state electrolytes

A01 | Electrode interface | Research

Date not stated

FACT

A comprehensive review published in 'Discover Electrochemistry' details a roadmap for solid electrolyte materials critical to the commercialization of all-solid-state lithium batteries. The study by Mohan Jagan and S. P.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P02.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 1/5 | DECISION LOCUS: BUSINESS / RULES

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P03

CATL: All-solid-state battery production timeline for 2027

A13 | Cell process | Product adoption

Date not stated

FACT

CATL aims for small-batch production of all-solid-state batteries by 2027, though current technology remains at TRL-4 (laboratory principle verification). Sulfide solid electrolytes, being moisture-sensitive and potentially generating hydrogen sulfide, necessitate ultra-dry production lines, making existing wet-process liquid electrolyte tools largely unusable. Unresolved process risks include solid-solid electrode interfaces, hot isostatic pressing yield, and dry electrode coating challenges.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P03.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

P04

NaCl Electrolytes: Al3+/O2- co-doping for Na-ion battery stability

A04 | Validation | Product adoption

Date not stated

FACT

Researchers have developed an Al3+/O2- co-doping strategy for NaCl-based solid electrolytes, achieving a high ionic conductivity of $2.7 \times 10^{-4} \text{ S cm}^{-1}$ at 30°C. This method introduces Na+ vacancies and a mixed anion environment, transforming NaCl into a fast-ion-conducting solid electrolyte with a wide electrochemical stability window of 1.05~4.24 V vs. Na2Sn.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P04.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P05

Sulfide Films: Roll-to-roll ASSB manufacturing process explained

A08 | Vehicle deployment | Scale-up

Date not stated

FACT

An innovative quasi-dry sulfide film technology has made roll-to-roll manufacturing for all-solid-state batteries a reality. This technique enables the production of 28µm freestanding sulfide electrolyte films with high conductivity and decimeter-scale area, achieving excellent pouch cell performance for over a thousand cycles. This represents a significant manufacturing breakthrough toward the mass production of solid-state batteries.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P05.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 5/5 | DECISION LOCUS: BUSINESS / RULES

P06

Factorial Energy: Sulfide electrolyte scale-up with Mitsui Kinzoku

A12 | Electrolyte | Product adoption

Date not stated

FACT

Solid-state battery developer Factorial Energy has partnered with Mitsui Kinzoku, a key supplier of sulfide solid electrolytes, to scale up solid-state battery technology. Factorial's proprietary Solstice solid-state platform will integrate with Mitsui Kinzoku's electrolyte technology. Factorial's manufacturing process is compatible with approximately 80% of existing lithium-ion battery production equipment and uses a unique dry cathode process to reduce manufacturing costs and energy consumption.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P06.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P07

Sichuan University: Ultra-high-nickel ASSB specs and 240mAh/g

A06 | Electrode interface | Product adoption

Date not stated

FACT

Sichuan University researchers announced a groundbreaking ultra-high-nickel all-solid-state battery. This new design achieves a discharge specific capacity exceeding 240mAh/g at 0.1C and demonstrates excellent solid-solid interfacial stability. This breakthrough holds significant potential for substantially improving the energy density and reliability of all-solid-state batteries.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P07.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

P08

LiBEST, Kangwon University | Next-Gen Battery Materials, LMFP & Si/C Anode

A11 | Cell process | Product adoption

Date not stated

FACT

LiBEST and Kangwon National University are expanding their partnership to jointly develop next-generation battery materials and process technologies. Professor Choi Sung-hoon's team is researching sulfide-based solid electrolyte separators, dry silicon/carbon (Si/C) graphite anodes, high-areal capacity anodes for XFC, and high-voltage lithium manganese iron phosphate (LMFP) cathodes.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P08.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 4/5 | DECISION LOCUS: BUSINESS / RULES

FACT is source-bound. BUSINESS READ, ACTION and UNKNOWN are explicit editorial layers.

P09

ORNL STAR Lab: Sulfide battery manufacturing scalability specs

A02 | Validation | Pilot

Date not stated

FACT

Oak Ridge National Laboratory's STAR Lab is actively researching the manufacturing scalability of all-solid-state batteries, specifically focusing on sulfide solid electrolytes. Researchers are addressing critical challenges such as maintaining electrode-electrolyte contact during operation and managing material sensitivity to moisture and processing reactions.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P09.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 20/25 | MATURITY 2/5 | DECISION LOCUS: BUSINESS / RULES

P10

NCM811 Cathode: Sulfide-based ASSB interface challenges explained

A09 | Vehicle deployment | Research

Date not stated

FACT

A new review highlights critical challenges in hybrid cathodes for sulfide-based all-solid-state lithium-ion batteries (ASSBs), focusing on interfacial side reactions, high resistance, and limited Li+ diffusion paths. Breakthroughs in in-situ and gradient coating, such as converting residual lithium compounds on NCM811 surfaces to functional Li-Ta-O-F or Li3VO4 layers, effectively passivate interfaces and suppress solid electrolyte decomposition.

WHY IT MATTERS

The decision relevance is interface stability, manufacturability, safety and automotive qualification. The signal should be tested at the application and operating-system level, not accepted from a headline alone.

BUSINESS READ

For operating companies, compare the reported change with current qualification, sourcing and product-roadmap assumptions. For suppliers, show powder, interface and process consistency together with scale and cost.

ACTION

Within 30 days, compare cell evidence under practical loading, pressure, temperature and cycle conditions; record the evidence and owner against P10.

UNKNOWN

Still unproven or incompletely stated: loading, pressure, interface resistance, yield, safety, capacity and timing.

EDITORIAL SCORE 19/25 | MATURITY 1/5 | DECISION LOCUS: BUSINESS / RULES

Playbook and 0-5 year roadmap

STAKEHOLDER	NOW 0-30 DAYS	NEXT 1-12 MONTHS	LATER 1-5 YEARS
Operating companies	compare cell evidence under practical loading, pressure, temperature and cycle conditions	Run production-like qualification with explicit acceptance and stop criteria.	Build a portfolio and architecture that can absorb technology and supplier changes.
Materials, equipment and technology suppliers	show powder, interface and process consistency together with scale and cost	Create shared reliability, process-window and failure-analysis data with customers.	Standardize interfaces, traceability, lifecycle support and recovery services.
Trading, investment and legal teams	Map loading, pressure, interface resistance, yield, safety, capacity and timing.	Contract for capacity, quality, change notice, liability, alternatives and exit.	Diversify regional, technical and customer concentration risk.

ROADMAP

NOW 0-30 DAYS Evidence ledger Owner: Strategy + quality Deliverable: claim, source, condition, owner	NOW 0-30 DAYS Risk screen Owner: Procurement + legal Deliverable: unknowns, alternatives, stop	NEXT 1-12 MONTHS Joint qualification Owner: R&D + supplier Deliverable: process window and failure data
NEXT 1-12 MONTHS Commercial gate Owner: Business + finance Deliverable: unit economics and capacity	LATER 1-5 YEARS Platform strategy Owner: Executive team Deliverable: portfolio and interface roadmap	LATER 1-5 YEARS Service layer Owner: Operations + channel Deliverable: monitoring, maintenance and recovery

GO / NO-GO GATES

GATE	OWNER	REQUIRED EVIDENCE	NO-GO CONDITION
G1 Evidence	Quality	Source, test conditions and reproducibility	No traceable evidence
G2 Integration	R&D	Interface, process window and failure analysis	Cannot meet system conditions
G3 Commercial	Business	Capacity, total cost, contract and alternatives	Economics or supply cannot be supported
G4 Lifecycle	Operations	Monitoring, maintenance, change notice and exit	No accountable operating plan

ANALYZED ARTICLES | ITEMS 01-14

Every title and URL is displayed in full. URLs wrap without shortening and remain clickable. A verified-reference label means the translated HTML did not retain its original source URL.

ID	FULL ARTICLE TITLE	FULL SOURCE / VERIFIED REFERENCE URL - CLICKABLE
A01	Sulfide and LLZO: 2026 roadmap for all-solid-state electrolytes	https://bioengineer.org/solid-state-battery-breakthrough-scientists-map-the-perfect-electrolyte/
A02	ORNL STAR Lab: Sulfide battery manufacturing scalability specs	https://www.ornl.gov/news/star-lab-tests-whether-battery-advances-can-scale
A03	Jiangnan University: Ball-milled Si/C anode for sulfide batteries	https://bioengineer.org/ball-milled-and-cvd-silicon-anodes-face-off-in-all-solid-state-batteries/
A04	NaCl Electrolytes: Al ³⁺ /O ₂ - co-doping for Na-ion battery stability	https://www.oaepublish.com/articles/energymater.2026.211
A05	Li ₆ PS ₅ Cl: Lithium ion mobility explained via neutron scattering	https://www.energy.gov/science/bes/articles/hops-and-jumps-help-lithium-ions-flow-faster-solid-state-battery-material
A06	Sichuan University: Ultra-high-nickel ASSB specs and 240mAh/g	https://news.metal.com/newscontent/104133566-solid-state-sichuan-university-unveils-ultra-high-nickel-all-solid-state-battery-breakthroughs
A07	Sodium-ion batteries: AI material search and 99.96% efficiency	https://bioengineer.org/how-ai-is-speeding-the-hunt-for-cheaper-safer-sodium-ion-battery-materials/
A08	Sulfide Films: Roll-to-roll ASSB manufacturing process explained	https://schumpeter.substack.com/p/quasi-dry-sulfide-films-turn-solid
A09	NCM811 Cathode: Sulfide-based ASSB interface challenges explained	https://www.voltcoffer.com/recent-advances-and-future-perspectives-on-hybrid-cathodes-for-sulfide-based-all-solid-state-lithium-ion-batteries/
A10	Ion Energy: Polymer ASSB specs, 520Wh/kg and 6-min charge time	https://news.metal.com/en/newscontent/104133997-solid-state-battery-weekly-li2s-production-line-construction-accelerates-while-cost-contradiction-remains-unresolved
A11	LiBEST, Kangwon University Next-Gen Battery Materials, LMFP & Si/C Anode	https://www.thelec.net/news/articleView.html?idxno=14116
A12	Factorial Energy: Sulfide electrolyte scale-up with Mitsui Kinzoku	https://carboncredits.com/factorial-energy-fac-teams-up-with-mitsui-kinzoku-to-scale-solid-state-batteries/
A13	CATL: All-solid-state battery production timeline for 2027	https://pandaily.com/catl-2027-all-solid-state-small-batch
A14	EV Battery Restoration: Chemical bath SEI removal method explained	https://www.goodnewsnetwork.org/scientists-pioneer-chemical-bath-method-to-restore-aging-ev-batteries-without-breaking-them-down/

SolidStateBattery — Selected Articles

Date: 2026-09-27

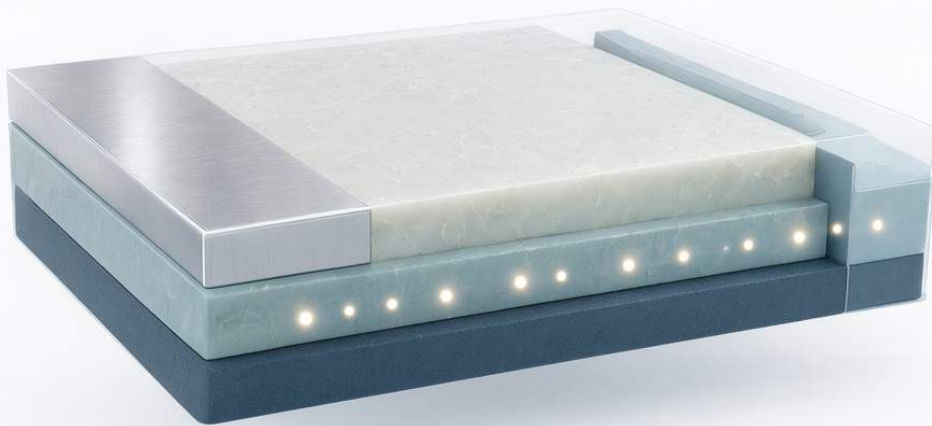
Articles: 14

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#01 Sulfide and LLZO: 2026 roadmap for all-solid-state electrolytes

Published September 22, 2026 Bioengineer.org USA



OVERVIEW

A comprehensive review published in 'Discover Electrochemistry' details a roadmap for solid electrolyte materials critical to the commercialization of all-solid-state lithium batteries. The study by Mohan Jagan and S. P. Vijayachamundeeswari systematically analyzes four inorganic solid electrolyte families—NASICON, garnet, perovskite, and sulfide—concluding that atomic-scale engineering of crystal structures, defects, and interfaces can achieve ionic conductivities comparable to or exceeding existing flammable liquid electrolytes. Sulfide and LLZO-type electrolytes are highlighted as the most promising candidates for next-generation all-solid-state batteries, with a combined strategy of compositional engineering, defect control, and phase stabilization deemed essential for resolving interfacial challenges and accelerating practical deployment.

Key Findings

A comprehensive review paper published in 'Discover Electrochemistry' has laid out a clear roadmap for solid electrolyte materials, aiming to accelerate the commercialization of all-solid-state lithium batteries. The paper specifically identifies sulfide and LLZO (Lithium Lanthanum Zirconium Oxide) electrolytes as the most promising candidates for next-generation all-solid-state batteries, demonstrating that atomic-scale engineering of crystal structures, defects, and interfaces can achieve ionic conductivities that rival or surpass those of existing flammable liquid electrolytes.

Technical / Clinical Details

The research, conducted by Mohan Jagan and S. P. Vijayachamundeeswari, systematically analyzed four major inorganic solid electrolyte families: NASICON, garnet, perovskite, and sulfide. A key insight from the study is the potential for achieving high ionic conductivity through precise engineering at the atomic scale, focusing on crystal structure, defect chemistry, and interfacial properties. Sulfide-based electrolytes, such as $\text{Li}_{10}\text{GeP}_2\text{S}_{12}$ (LGPS), are noted for their high room-temperature ionic conductivity, often exceeding $10^{-2} \text{ S cm}^{-1}$, which is comparable to liquid electrolytes. Garnet-type electrolytes, particularly LLZO, are praised for their excellent stability with lithium metal and high safety profiles, despite challenges related to high grain boundary resistance. The paper details that a multi-pronged strategy involving compositional optimization, precise control over defect density, and stabilization of different phases is crucial for reducing interfacial resistance and enhancing the chemical and electrochemical stability of these materials. This comprehensive analysis provides a vital framework for developing solid electrolytes that offer both high practical ionic conductivity and long-term stability.

Background & Context

All-solid-state batteries are anticipated to be a transformative technology, offering significant advantages over conventional lithium-ion batteries that use liquid electrolytes. These advantages include inherent safety due to the elimination of flammable liquid components, higher energy density, and extended cycle life, making them critical for the advancement of electric vehicles (EVs) and grid-scale energy storage. However, the primary hurdles to their widespread adoption have been the relatively low ionic conductivity of solid electrolytes and high interfacial resistance between the solid electrolyte and electrodes. This review paper addresses these challenges directly by providing specific directions for overcoming them, thus offering clear guidance to research institutions and industrial players in the development of solid electrolyte materials. The clarification of technical milestones is expected to streamline and accelerate the overall development process.

Strategic Significance & Outlook

This roadmap is fundamental to resolving the technological bottlenecks hindering the commercialization of all-solid-state batteries. Further research and development focusing on sulfide and LLZO electrolytes are expected to intensify, with advances in atomic-level material design and interface engineering poised to make the mass production of high-performance and safe all-solid-state batteries a reality. Key challenges ahead will include establishing cost-effective synthesis methods for large-scale production and optimizing the matching between electrolyte and electrode materials. The findings from this research are set to significantly bolster the evolution of next-generation battery technologies, which are essential for realizing a cleaner energy future.

Source: <https://bioengineer.org/solid-state-battery-breakthrough-scientists-map-the-perfect-electrolyte/>

#02 ORNL STAR Lab: Sulfide battery manufacturing scalability specs

Published September 18, 2026 Oak Ridge National Laboratory USA



OVERVIEW

Oak Ridge National Laboratory's STAR Lab is actively researching the manufacturing scalability of all-solid-state batteries, specifically focusing on sulfide solid electrolytes. Researchers are addressing critical challenges such as maintaining electrode-electrolyte contact during operation and managing material sensitivity to moisture and processing reactions. The lab's work on both dry and liquid-based manufacturing approaches aims to optimize processing choices for improved material properties and battery performance.

Key Findings

The STAR Lab at Oak Ridge National Laboratory (ORNL) is undertaking a crucial investigation into the scalability of manufacturing processes for all-solid-state batteries, with a particular emphasis on sulfide solid electrolytes. The research directly confronts significant barriers to commercialization, including how to sustain robust contact between electrodes and the solid electrolyte during battery operation, and mitigating issues arising from the inherent moisture sensitivity of sulfide materials during processing. By addressing these fundamental challenges, ORNL aims to pave the way for more efficient and cost-effective large-scale production of these next-generation batteries.

Technical / Clinical Details

Researchers at STAR Lab are systematically evaluating both dry and liquid-based manufacturing methodologies for solid-state batteries. The dry processing approach, which avoids the use of solvents, offers environmental benefits and simplifies certain steps, but presents difficulties in achieving uniform material distribution and dense packing. Conversely, liquid-based methods can facilitate better material homogeneity but introduce complexities related to the sulfide electrolyte's reactivity with solvents and moisture. The lab is meticulously studying how these different processing choices impact critical material properties, such as ionic conductivity, interfacial resistance, and ultimately, the battery's overall performance metrics including cycle life and power output. Understanding these interdependencies is vital for optimizing manufacturing protocols.

Background & Context

All-solid-state batteries are heralded as a transformative technology for energy storage due to their enhanced safety profiles, higher energy densities, and longer lifespans compared to conventional lithium-ion batteries. They are particularly promising for electric vehicles (EVs) and grid-scale energy storage. However, the path to mass production is fraught with challenges, primarily stemming from the complexity and high cost of current manufacturing techniques. Sulfide solid electrolytes are attractive for their high ionic conductivity but demand precise control during fabrication. ORNL's involvement underscores the strategic importance of overcoming these manufacturing hurdles to accelerate the deployment of advanced battery technologies and strengthen the U.S. competitive position in the global battery supply chain.

Strategic Significance & Outlook

The work at STAR Lab is foundational for developing scalable and cost-effective manufacturing techniques for solid-state batteries. The insights gained from this research will not only accelerate the practical application of sulfide-based all-solid-state batteries but will also contribute significantly to the broader adoption of EVs and the integration of renewable energy sources. By elucidating the profound impact of manufacturing choices on material interfaces and overall battery performance, this research is expected to provide definitive guidelines for future battery design and production strategies, marking a critical step towards unlocking the full potential of solid-state energy storage.

Source: <https://www.ornl.gov/news/star-lab-tests-whether-battery-advances-can-scale>

Collected: September 25, 2026 | Automated Research System (Gemini API)

#03 Jiangnan University: Ball-milled Si/C anode for sulfide batteries

Published September 24, 2026 Bioengineer.org (referencing Discover Electrochemistry, Jiangnan University) China



OVERVIEW

Researchers at Jiangnan University compared three silicon-based anode materials in sulfide-based all-solid-state lithium batteries, concluding that long-term cycling performance is primarily governed by structural stability under mechanical confinement, rather than solely by charge-transfer kinetics. Their study identified ball-milled silicon/carbon composites as the optimal anode choice, balancing cost and performance effectively for sulfide solid-state battery applications.

Key Findings

A study conducted by researchers at Jiangnan University has identified ball-milled silicon/carbon composites as the optimal anode material for sulfide-based all-solid-state lithium batteries, balancing both cost and performance. The research revealed that within the mechanical confinement provided by solid electrolytes, the long-term cycling performance of silicon anodes is predominantly governed by their structural stability rather than solely by charge-transfer kinetics, a crucial insight for future anode design.

Technical / Clinical Details

The research team evaluated the performance of three distinct silicon-based anode materials: pure nano-silicon, ball-milled (BM) silicon/carbon composites, and chemical vapor deposition (CVD) silicon/carbon composites, all integrated into sulfide-based all-solid-state lithium batteries. Experimental results demonstrated that the mechanical pressure exerted by the solid electrolyte plays a significant role in suppressing the large volume changes of silicon during lithiation/delithiation, thereby mitigating electrode degradation over cycles. Specifically, the BM silicon/carbon composite exhibited superior performance due to its effective construction of a conductive network and efficient management of mechanical stress. This balance enabled high energy density coupled with stable cycling. While pure nano-silicon offered excellent initial efficiency, it suffered from long-term stability issues, and CVD-silicon, though stable, proved to be cost-prohibitive.

Background & Context

All-solid-state batteries are a frontrunner for next-generation energy storage, promising higher energy density and enhanced safety. Silicon, with its theoretical capacity significantly exceeding graphite (approx. 4200 mAh/g vs. 372 mAh/g), is considered a promising anode material for achieving ultra-high energy density. However, silicon's major drawback is its enormous volume expansion (over 300%) during cycling, which leads to rapid structural degradation and poor cycle life. This study leverages the unique mechanical confinement effect of solid electrolytes and focuses on appropriate composite design and processing methods to overcome silicon anode limitations, contributing significantly to the practical development of all-solid-state batteries.

Strategic Significance & Outlook

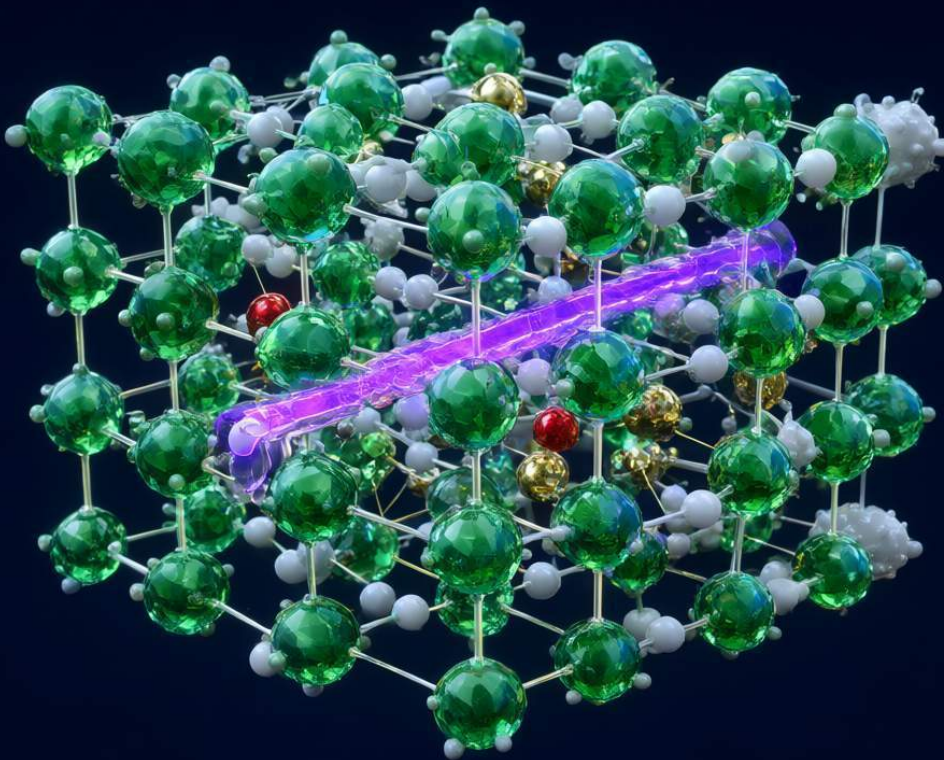
The identification and optimization of ball-milled silicon/carbon composite anodes represent a critical step towards accelerating the commercialization of sulfide-based all-solid-state batteries. This technology holds the potential to enable high-energy-density, long-lifecycle solid-state batteries, which could dramatically extend the range of electric vehicles and improve the battery life of portable electronic devices. Future work is expected to focus on developing even more cost-effective manufacturing processes and conducting rigorous durability assessments under practical operating conditions. The emphasis on conductive network construction and mechanical stress management provides clear guidelines for next-generation anode material engineering, pushing the boundaries of what is achievable in solid-state energy storage.

Source: <https://bioengineer.org/ball-milled-and-cvd-silicon-anodes-face-off-in-all-solid-state-batteries/>

Collected: September 25, 2026 | Automated Research System (Gemini API)

#04 NaCl Electrolytes: Al³⁺/O²⁻- co-doping for Na-ion battery stability

Published September 24, 2026 Academic Publication Unknown



OVERVIEW

Researchers have developed an Al³⁺/O²⁻- co-doping strategy for NaCl-based solid electrolytes, achieving a high ionic conductivity of $2.7 \times 10^{-4} \text{ S cm}^{-1}$ at 30°C. This method introduces Na⁺ vacancies and a mixed anion environment, transforming NaCl into a fast-ion-conducting solid electrolyte with a wide electrochemical stability window of 1.05~4.24 V vs. Na₂Sn. All-solid-state cells utilizing this optimized material demonstrated 83% capacity retention after 100 cycles at 0.3 C, highlighting its potential for low-cost, stable sodium-ion solid-state batteries.

Key Findings

A research team has successfully developed a novel $\text{Al}^{3+}/\text{O}^{2-}$ co-doping strategy for NaCl-based solid electrolytes, achieving a remarkable ionic conductivity of $2.7 \times 10^{-4} \text{ S cm}^{-1}$ at 30°C . This breakthrough transforms conventional NaCl into a highly efficient, fast-ion-conducting solid electrolyte, paving the way for advanced, low-cost sodium-ion solid-state batteries.

Technical / Clinical Details

The innovative co-doping mechanism effectively introduces a significant concentration of Na^+ vacancies and creates a mixed anion environment within the NaCl lattice, which is critical for enhancing ionic mobility. This modified solid electrolyte exhibits a broad electrochemical stability window of 1.05 to 4.24 V versus Na_2Sn , a crucial parameter for practical battery applications. All-solid-state cells constructed with this optimized material demonstrated excellent cycling stability, retaining 83% of their initial capacity after 100 cycles at a 0.3 C rate. This performance underscores the material's potential to significantly improve the durability and reliability of sodium-ion solid-state battery technology.

Background & Context

The escalating concerns over lithium resource scarcity and cost have propelled research into alternative battery chemistries, with sodium-ion batteries emerging as a promising candidate for next-generation energy storage. However, existing sodium-ion solid electrolytes often suffer from inadequate performance or stability. The NaCl-based material presented in this study offers a compelling advantage due to its use of abundant and inexpensive raw materials, which could lead to substantial reductions in battery manufacturing costs. This cost-effectiveness is particularly attractive for large-scale energy storage systems, where economic viability is paramount.

Strategic Significance & Outlook

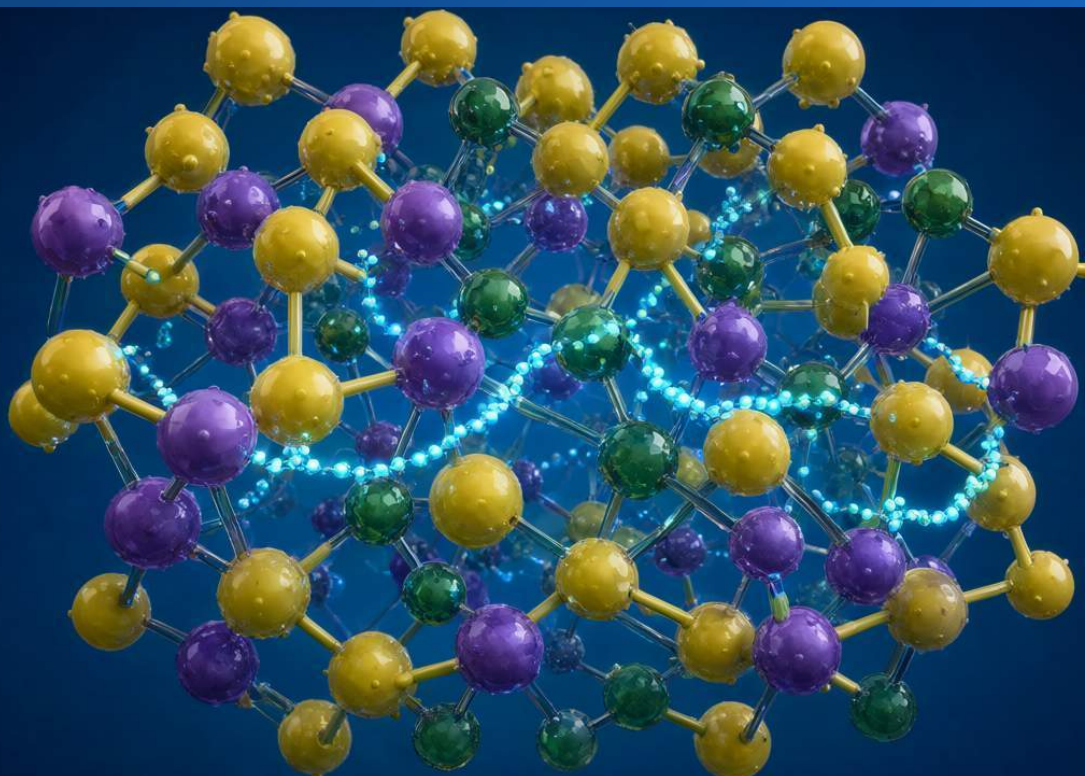
This Al₃⁺/O₂⁻ co-doping strategy marks a significant advancement toward developing low-cost, dry-air-stable solid electrolytes, making the commercialization of safer, longer-lasting, and more environmentally friendly sodium-ion solid-state batteries more attainable. Future research will likely focus on further increasing ionic conductivity, optimizing interfacial stability, and exploring scalability for industrial production, thereby accelerating the deployment of this promising technology in various energy applications.

Source: <https://www.oaepublish.com/articles/energymater.2026.211>

Collected: September 25, 2026 | Automated Research System (Gemini API)

#05 Li₆PS₅Cl: Lithium ion mobility explained via neutron scattering

Published September 23, 2026 Research highlight (U.S. Department of Energy) USA



OVERVIEW

Researchers have leveraged neutron scattering and computer simulations to reveal that lithium ions exhibit liquid-like mobility through vibrating bottlenecks within the promising superionic conductor Li₆PS₅Cl, even as the electrolyte maintains a solid state. This insight into rapid ionic motion could lead to solid electrolyte materials with higher mobile ion quantities and improved chemical/thermal stability, enabling faster, safer battery charging comparable to liquid electrolytes.

Key Findings

A recent study, combining neutron scattering techniques with advanced computer simulations, has elucidated the surprising behavior of lithium ions within lithium phosphorus sulfur chloride ($\text{Li}_6\text{PS}_5\text{Cl}$), a highly promising superionic conductor for solid-state batteries. The research reveals that lithium ions achieve remarkable liquid-like mobility through vibrating "bottlenecks" within the solid electrolyte structure, offering a new pathway to significantly enhance solid-state battery performance.

Technical / Clinical Details

The detailed analysis showed that within the crystalline framework of $\text{Li}_6\text{PS}_5\text{Cl}$, specific pathways exist where lithium ions perform rapid "hops and jumps" through dynamically vibrating constricted regions, or bottlenecks. This behavior, reminiscent of ion transport in liquids, explains the high ionic conductivity observed despite the material remaining in a solid state. This profound insight provides critical design principles for developing solid electrolyte materials with a higher concentration of mobile ions, concurrently improving their chemical and thermal stability. Such advancements are crucial for achieving charging speeds and safety profiles comparable to, or even exceeding, those of traditional liquid electrolytes.

Background & Context

Solid-state batteries are heralded as the next generation of battery technology, promising to resolve key safety concerns of current lithium-ion batteries (e.g., electrolyte leakage and fire hazards) while offering higher energy densities and longer lifespans. However, the typically slower ionic conductivity within solid electrolytes compared to liquid counterparts has been a major hurdle to their practical implementation. This research represents a significant breakthrough in overcoming this challenge and accelerating the development of high-performance solid-state batteries.

Strategic Significance & Outlook

This discovery has implications not only for sulfide-based solid electrolytes like $\text{Li}_6\text{PS}_5\text{Cl}$ but also for the rational design of other types of solid electrolyte materials. By deepening the atomic-level understanding of ion dynamics, researchers will be better equipped to engineer superior superionic conductors. Ultimately, this will pave the way for the development of faster, safer, and more efficient solid-state batteries for electric vehicles, portable electronics, and large-scale energy storage systems.

Source: <https://www.energy.gov/science/bes/articles/hops-and-jumps-help-lithium-ions-flow-faster-solid-state-battery-material>

Collected: September 25, 2026 | Automated Research System (Gemini API)

#06 Sichuan University: Ultra-high-nickel ASSB specs and 240mAh/g

Published September 24, 2026 news.metal.com China



OVERVIEW

Sichuan University researchers announced a groundbreaking ultra-high-nickel all-solid-state battery. This new design achieves a discharge specific capacity exceeding 240mAh/g at 0.1C and demonstrates excellent solid-solid interfacial stability. This breakthrough holds significant potential for substantially improving the energy density and reliability of all-solid-state batteries.

Key Findings

A research team at Sichuan University has achieved a remarkable breakthrough in all-solid-state battery technology by developing an ultra-high-nickel cathode. This novel design delivers an impressive energy density, exceeding 240mAh/g at a 0.1C discharge specific capacity, which promises to significantly extend the range of electric vehicles (EVs) and the operating time of portable devices.

Technical Details

The core of this research lies in overcoming the particularly challenging interfacial issues between ultra-high-nickel cathodes and solid electrolytes. Traditional ultra-high-nickel cathodes, despite their high energy density potential, suffer from instability and side reactions at the interface with solid electrolytes. The Sichuan University team successfully developed a unique technology to stabilize this interface, inhibiting dendrite formation while maintaining high ionic conductivity. This ensures high capacity retention and stability over extended charge-discharge cycles. Although specific details of the interfacial stabilization technique were not fully disclosed, it is suggested that a special buffer layer was introduced between the solid electrolyte and cathode material, or a surface modification technique was employed. This technology also reduces internal resistance and achieves high power characteristics.

Background & Context

Ultra-high-nickel cathode materials are considered one of the most promising avenues for increasing the energy density of both lithium-ion and all-solid-state batteries. However, increasing nickel content often leads to reduced thermal stability and increased reactivity with electrolytes. In all-solid-state batteries, in particular, interfacial problems have been a primary cause of performance degradation. Sichuan University's achievement resolves this long-standing challenge, marking a crucial step towards the commercialization of all-solid-state batteries.

Strategic Significance & Outlook

This technical breakthrough has the potential to elevate the energy density of all-solid-state batteries far beyond current lithium-ion battery levels. The next focus will be on scaling up this technology and establishing mass production processes. EV manufacturers, in particular, are expected to show significant interest in this technology, which offers both extended range and enhanced safety. This research further solidifies China's leadership in the development of high-performance next-generation batteries.

Source: <https://news.metal.com/newscontent/104133566-solid-state-sichuan-university-unveils-ultra-high-nickel-all-solid-state-battery-breakthroughs>

Collected: September 26, 2026 | Automated Research System (Gemini API)

#07 Sodium-ion batteries: AI material search and 99.96% efficiency

Published September 25, 2026 Bioengineer.org Unknown



OVERVIEW

Artificial intelligence (AI) is accelerating the search for cheaper and safer sodium-ion battery materials. Notably, AI-engineered anode-free designs have achieved Coulombic efficiencies approaching 99.96% for sodium-metal interfaces. This technology contributes to developing next-generation batteries with high energy density and long cycle life, making lithium-independent battery solutions a reality.

Key Findings

Bioengineer.org reports that Artificial Intelligence (AI) is dramatically accelerating the search for sodium-ion battery materials. By leveraging AI, the identification of cheaper and safer materials has become possible, with reported Coulombic efficiencies reaching an extremely high level of 99.96% for sodium-metal interfaces in anode-free designs. This marks a crucial advancement in developing next-generation batteries that combine high energy density with extended lifespan.

Technical Details

Traditional material discovery has relied on extensive experimental trial-and-error, consuming considerable time and cost. However, AI, utilizing machine learning algorithms, can rapidly predict promising combinations from millions of material candidates, dramatically improving the efficiency of experimental verification. This AI-driven approach is helping to resolve one of the most challenging issues in sodium-ion batteries: the instability of the sodium metal anode. Anode-free designs aim to maximize energy density by directly utilizing sodium metal as the anode, similar to lithium metal anodes in lithium-ion batteries. However, a major problem has been the non-uniform deposition of sodium metal during charge-discharge cycles, leading to dendrite formation that compromises safety and lifespan. This research reports that AI-designed sodium metal interfaces achieved a remarkable Coulombic efficiency of 99.96%. This means that nearly all sodium ions are deposited onto the anode during charging and efficiently utilized during discharge. Such high Coulombic efficiency is critical for significantly extending battery cycle life and enhancing safety.

Background & Context

Driven by the uneven distribution and price volatility of lithium resources, as well as safety concerns surrounding lithium-ion batteries, sodium-ion batteries are gaining attention as a next-generation primary energy storage technology. Sodium is abundant on Earth and is affordably accessible. However, its larger ionic radius compared to lithium has presented technical challenges in electrode material selection and anode interface stabilization. The introduction of AI accelerates the resolution of these issues, potentially realizing sustainable, lithium-independent energy storage solutions.

Strategic Significance & Outlook

AI-powered material discovery platforms are expected to be applied not only to sodium-ion batteries but also to all-solid-state batteries and other innovative battery technologies. The achievement of 99.96% Coulombic efficiency indicates that sodium-ion batteries are approaching practical performance levels, increasing the likelihood of commercialization within the next few years. This technology is projected to play a significant role as an alternative to lithium-ion batteries in stationary energy storage systems and cost-sensitive electric vehicle segments. The convergence of AI and materials science is poised to profoundly transform the future of battery technology.

Source: <https://bioengineer.org/how-ai-is-speeding-the-hunt-for-cheaper-safer-sodium-ion-battery-materials/>

Collected: September 26, 2026 | Automated Research System (Gemini API)

#08 Sulfide Films: Roll-to-roll ASSB manufacturing process explained

Published September 23, 2026 Schumpeter Substack Unknown



OVERVIEW

An innovative quasi-dry sulfide film technology has made roll-to-roll manufacturing for all-solid-state batteries a reality. This technique enables the production of 28 μ m freestanding sulfide electrolyte films with high conductivity and decimeter-scale area, achieving excellent pouch cell performance for over a thousand cycles. This represents a significant manufacturing breakthrough toward the mass production of solid-state batteries.

Key Findings

Schumpeter reports a groundbreaking advancement in all-solid-state battery manufacturing: the 'quasi-dry sulfide film' technology now enables the application of roll-to-roll manufacturing processes. This novel technique allows for the production of freestanding electrolyte films that are 28 micrometers (μm) thin, possess high ionic conductivity, and span decimeter-scale areas, while also achieving excellent pouch cell performance for over a thousand cycles. This represents a significant step towards overcoming a major challenge in the mass production of all-solid-state batteries.

Technical Details

Traditional solid electrolyte manufacturing processes, particularly for sulfide-based electrolytes, often require complex wet processes or high-temperature sintering, which have been bottlenecks for manufacturing costs and scalability. However, the newly developed quasi-dry sulfide film technology employs a process that minimizes solvent usage while directly forming thin films of sulfide solid electrolytes. This significantly simplifies the manufacturing process, reduces costs, and enhances the uniformity and quality of the electrolyte films.

- **Film Thickness and Conductivity:** The developed electrolyte film is exceptionally thin at 28 μm , contributing to increased battery energy density. Simultaneously, it maintains high ionic conductivity, indicating efficient lithium-ion transport.
- **Scale and Morphology:** The ability to manufacture at a decimeter scale (tens of centimeters) suggests potential applicability to relatively large battery cells. Being a freestanding film, it also offers versatility for flexible designs.
- **Cycle Performance:** Prototype pouch cells demonstrated high capacity retention over more than a thousand charge-discharge cycles, indicating long-term durability. This is a crucial reliability metric for practical application.

Background & Context

All-solid-state batteries are considered essential next-generation technology for extending the range of electric vehicles (EVs), shortening charging times, and enhancing safety. However, their high cost and complex manufacturing processes have been long-standing challenges. Specifically, the formation of the solid electrolyte layer has presented a significant barrier in terms of throughput and cost, necessitating the establishment of continuous production technologies like roll-to-roll. This quasi-dry sulfide film technology provides a direct solution to precisely this manufacturing challenge.

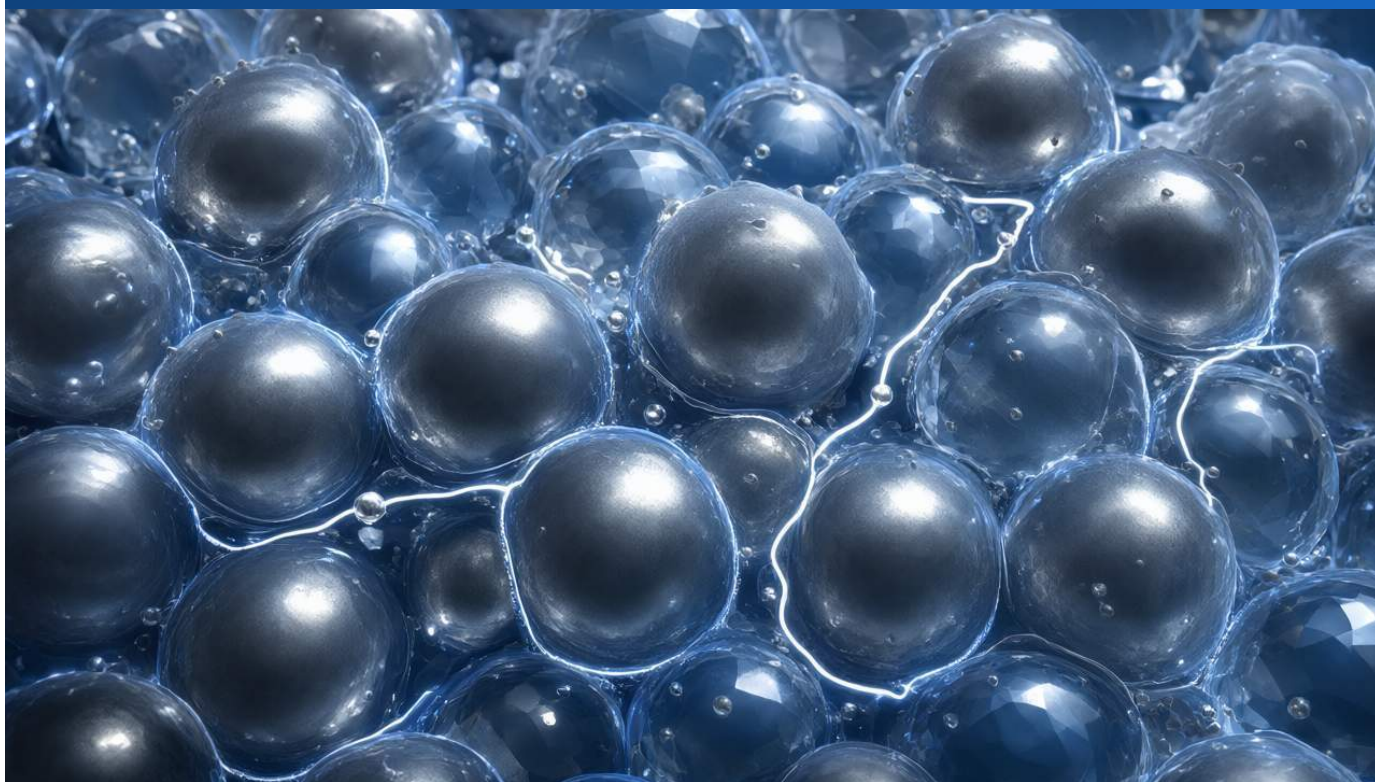
Strategic Significance & Outlook

This technology is expected to significantly reduce the manufacturing cost of all-solid-state batteries and pave the way for large-scale production, thereby accelerating the adoption of all-solid-state batteries in the electric vehicle market. Furthermore, the thin film structure and high cycle performance also enable applications in more compact and higher-performance portable devices. Future efforts are anticipated to focus on further optimization of this technology and its integration into existing battery manufacturing lines. This breakthrough marks a critical milestone towards the commercialization of next-generation battery technology.

Source: <https://schumpeter.substack.com/p/quasi-dry-sulfide-films-turn-solid>

#09 NCM811 Cathode: Sulfide-based ASSB interface challenges explained

Published September 19, 2026 Volt Coffer International



OVERVIEW

A new review highlights critical challenges in hybrid cathodes for sulfide-based all-solid-state lithium-ion batteries (ASSBs), focusing on interfacial side reactions, high resistance, and limited Li^+ diffusion paths. Breakthroughs in in-situ and gradient coating, such as converting residual lithium compounds on NCM811 surfaces to functional Li-Ta-O-F or Li_3VO_4 layers, effectively passivate interfaces and suppress solid electrolyte decomposition. These advances leverage the high room-temperature ionic conductivity ($>10^{-3} \text{ S cm}^{-1}$) and mechanical properties of sulfide materials, positioning them as prime candidates for next-generation ASSBs.

Key Findings

A recent review comprehensively details the challenges and advancements in hybrid cathodes for sulfide-based all-solid-state lithium-ion batteries (ASSBs). The study highlights that composite cathodes, comprising active materials like NCM, sulfide solid electrolytes, and conductive carbon, suffer from severe issues such as interfacial side reactions, high interfacial resistance, and insufficient Li^+ diffusion pathways. A significant breakthrough involves in-situ or gradient coating techniques, demonstrating that converting residual lithium compounds on NCM811 surfaces into functional Li-Ta-O-F electrolyte layers or Li_3VO_4 (LVO) coatings effectively passivates the interface and suppresses solid electrolyte degradation.

Technical Details

The primary hurdle for high-performance ASSBs lies in stabilizing the cathode-electrolyte interface. Nickel-rich active materials like NCM811, in particular, exacerbate this issue due to residual lithium compounds on their surface, which react detrimentally with sulfide solid electrolytes. The proposed solutions involve precise surface engineering, where these reactive compounds are transformed into stable, ionically conductive layers. These engineered interfaces act as protective barriers, mitigating parasitic reactions while maintaining efficient Li-ion transport. Sulfide-based solid electrolytes are particularly promising owing to their high room-temperature ionic conductivity, exceeding $10^{-3} \text{ S cm}^{-1}$, and superior mechanical properties, which are crucial for durable and high-performing solid-state cells.

Background & Context

All-solid-state batteries are poised to revolutionize the electric vehicle (EV) and grid-scale energy storage sectors by offering enhanced energy density, improved safety, and extended cycle life over conventional lithium-ion batteries. Sulfide-based ASSBs are especially attractive for their high ionic conductivity, which promises rapid charging capabilities. Addressing the long-standing interfacial stability issues in composite cathodes is paramount for their commercial viability. The advancements in interface coating technologies represent a critical step towards realizing high-performance, mass-producible ASSBs.

Strategic Significance & Outlook

The continued optimization of interfacial stabilization techniques and the development of cost-effective, scalable manufacturing processes are crucial for future ASSB deployment. Further research is expected to focus on enhancing the uniformity of functional coating layers and exploring novel coating materials with even higher ionic conductivity. These technological advancements will enable sulfide-based all-solid-state batteries to significantly extend EV range, reduce charging times, and potentially establish a new benchmark for energy storage solutions globally.

Source: <https://www.voltcoffer.com/recent-advances-and-future-perspectives-on-hybrid-cathodes-for-sulfide-based-all-solid-state-lithium-ion-batteries/>

Collected: September 26, 2026 | Automated Research System (Gemini API)

#10 Ion Energy: Polymer ASSB specs, 520Wh/kg and 6-min charge time

Published September 24, 2026 Shanghai Metals Market (SMM) China



OVERVIEW

Ion Energy's Wuhan R&D and production base is now operational, moving its polymer all-solid-state batteries from testing to mass production. Their proprietary 51Ah automotive solid-state battery boasts an energy density of 520Wh/kg, 6-minute ultra-fast charging, and a cycle life over 3,500 cycles. The battery has successfully passed all GB38031-2025 national tests. Concurrently, Dongfeng Motor's 350Wh/kg solid-state battery mass production is delayed to Q4 2026, with a 0.2GWh pilot line currently running.

Key Findings

Ion Energy's Wuhan R&D and production base has officially commenced operations, signaling the transition of its polymer-based all-solid-state batteries from the testing and validation phase to large-scale production. The company's self-developed 51Ah automotive solid-state battery achieves an impressive energy density of 520Wh/kg, supports ultra-fast charging in just 6 minutes, and demonstrates an extended cycle life exceeding 3,500 cycles. Furthermore, this battery has successfully passed all stringent tests under China's national standard GB38031-2025, confirming its safety and reliability for market deployment.

Technical Details

An energy density of 520Wh/kg significantly surpasses that of existing lithium-ion batteries, promising a substantial increase in the driving range of electric vehicles (EVs). The 6-minute ultra-fast charging capability rivals the refueling time of gasoline-powered cars, addressing a major barrier to EV adoption. A cycle life exceeding 3,500 cycles reduces the frequency of battery replacements, lowering the total cost of ownership for vehicles. These performance metrics are achieved through a combination of advanced polymer solid electrolytes and optimized cell design, which also enhances thermal stability and durability.

Background & Context

All-solid-state batteries are anticipated as a next-generation technology poised to overcome the limitations of conventional liquid-electrolyte lithium-ion batteries in terms of safety, energy density, and charging speed. For automotive applications, safety and reliability are paramount, making compliance with national standards a prerequisite for market entry. China leads globally in EV and battery development, and Ion Energy's achievement further strengthens the nation's competitive position in this sector. However, the delay in Dongfeng Motor's solid-state battery mass production suggests that scaling up this technology still presents complex challenges.

Strategic Significance & Outlook

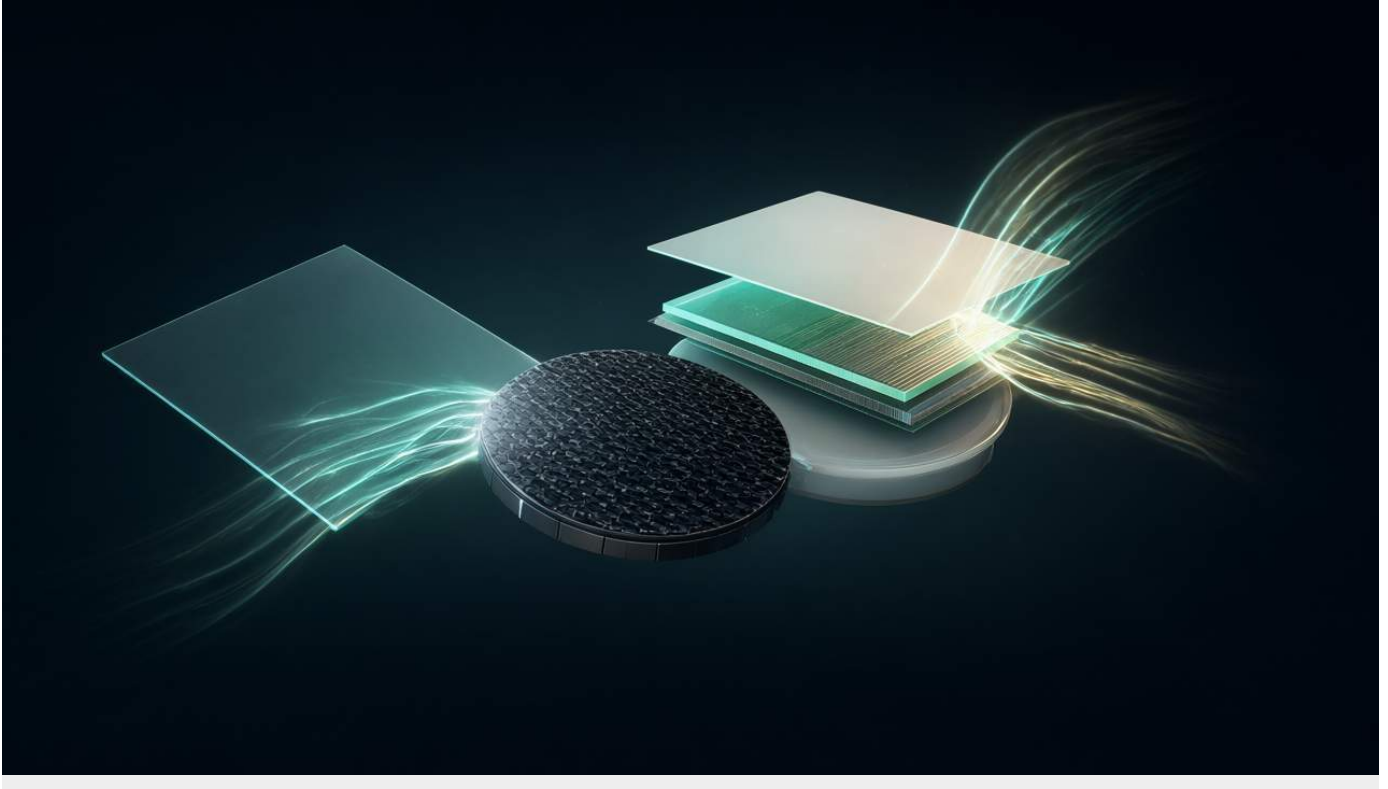
The move by Ion Energy towards large-scale production of polymer-based all-solid-state batteries is likely to have a profound impact on the EV market. A high-performance, safe, and ultra-fast charging automotive battery could accelerate consumer adoption of EVs. Future developments will focus on whether Ion Energy's technology is adopted by major automakers like Dongfeng Motor. The widespread adoption of this technology is expected to drive shifts across the entire battery supply chain, particularly in demand for electrolyte materials and manufacturing equipment.

Source: <https://news.metal.com/en/newscontent/104133997-solid-state-battery-weekly-li2s-production-line-construction-accelerates-while-cost-contradiction-remains-unresolved>

Collected: September 26, 2026 | Automated Research System (Gemini API)

#11 LiBEST, Kangwon University | Next-Gen Battery Materials, LMFP & Si/C Anode

Published September 22, 2026 The Elec South Korea



OVERVIEW

LiBEST and Kangwon National University are expanding their partnership to jointly develop next-generation battery materials and process technologies. Professor Choi Sung-hoon's team is researching sulfide-based solid electrolyte separators, dry silicon/carbon (Si/C) graphite anodes, high-areal capacity anodes for XFC, and high-voltage lithium manganese iron phosphate (LMFP) cathodes. Additionally, primer interface technology is under development to enhance adhesion and electrical conductivity in dry electrodes, marking a critical step towards advanced solid-state battery commercialization.

Key Findings

LiBEST, a Korean battery technology company, is intensifying its partnership with Kangwon National University to jointly develop next-generation battery materials and process technologies. Professor Choi Sung-hoon's research team is focusing on several key technologies indispensable for improving the performance of all-solid-state batteries. Specifically, they are advancing the development of sulfide-based solid electrolyte separators, high-performance dry silicon/carbon (Si/C) graphite anodes, high-area capacity anodes optimized for extreme fast charging (XFC), and high-voltage lithium manganese iron phosphate (LMFP) cathodes.

Technical Details

The core of this collaboration lies in innovating the fundamental components of all-solid-state batteries. Sulfide-based solid electrolyte separators offer high ionic conductivity and stability, significantly enhancing safety compared to traditional liquid electrolytes. Dry silicon/carbon graphite anodes leverage silicon's high capacity while mitigating volume expansion, contributing to longer lifespan and increased energy density. The high-area capacity anodes for XFC are designed to dramatically boost rapid charging performance. Furthermore, LMFP cathodes provide higher energy density and operating voltage than conventional LFP (lithium iron phosphate), elevating overall battery performance. A primer interface technology is also under development to improve adhesion and electrical conductivity in dry electrodes, crucial for manufacturing efficiency and battery reliability.

Background & Context

The global race for next-generation battery technology is intensifying, with all-solid-state batteries particularly anticipated as the ultimate solution to meet consumer demands for electric vehicle (EV) range, safety, and charging speed. South Korea, home to global manufacturers like LG Energy Solution and Samsung SDI, has established a strong position in the battery sector. This partnership between LiBEST and Kangwon National University represents a strategic move to promote integrated R&D from basic research to commercialization, further strengthening Korea's battery technology leadership.

Strategic Significance & Outlook

The joint development by LiBEST and Kangwon National University is expected to bring significant progress towards the commercialization of all-solid-state batteries. The integration of sulfide-based solid electrolytes, high-performance anodes, high-voltage cathodes, and advanced interface technologies will accelerate the realization of high-performance, safe, and ultra-fast charging solid-state batteries. Once these technologies are established, their adoption in various applications, including electric vehicles, drones, and wearable devices, is expected to grow, profoundly impacting the market. This partnership is key for South Korea to maintain its leadership in the global battery market.

Source: <https://www.thelec.net/news/articleView.html?idxno=14116>

Collected: September 26, 2026 | Automated Research System (Gemini API)

#12 Factorial Energy: Sulfide electrolyte scale-up with Mitsui Kinzoku

Published September 21, 2026 Factorial Energy USA



OVERVIEW

Solid-state battery developer Factorial Energy has partnered with Mitsui Kinzoku, a key supplier of sulfide solid electrolytes, to scale up solid-state battery technology. Factorial's proprietary Solstice solid-state platform will integrate with Mitsui Kinzoku's electrolyte technology. Factorial's manufacturing process is compatible with approximately 80% of existing lithium-ion battery production equipment and uses a unique dry cathode process to reduce manufacturing costs and energy consumption. The Solstice platform targets an energy density of up to 450Wh/kg.

Key Findings

Factorial Energy, a company specializing in solid-state battery technology, has announced a strategic partnership with Mitsui Kinzoku, one of the few producers of sulfide-based solid electrolytes. This collaboration aims to scale up the production of promising solid-state battery technology by integrating it into Factorial's Solstice solid-state platform.

Technical Details

At the core of this partnership is the integration of Factorial's Solstice solid-state battery platform with Mitsui Kinzoku's advanced sulfide solid electrolyte technology. Sulfide solid electrolytes are highly regarded for their high ionic conductivity and excellent low-temperature performance, making them particularly promising for EV applications. Mitsui Kinzoku's expertise is expected to further enhance the performance of the Solstice platform.

A distinctive feature of Factorial's manufacturing process is its proprietary dry cathode processing technology. This technology is compatible with approximately 80% of existing lithium-ion battery manufacturing equipment, offering the significant advantage of reducing capital expenditure, manufacturing costs, and energy consumption. This represents a crucial step towards the mass production and improved cost-efficiency of solid-state batteries. The Solstice platform targets a high energy density of up to 450Wh/kg, which could significantly extend the driving range of electric vehicles.

Background & Context

Solid-state batteries are considered a leading candidate for next-generation battery technology due to their superior safety (reduced fire risk) and higher energy density compared to conventional lithium-ion batteries with liquid electrolytes. However, challenges related to material stability, manufacturing complexity, and high costs have hindered their commercialization. The partnership between Factorial and Mitsui Kinzoku is seen as a strategic move to address these challenges, particularly concerning manufacturing cost and scalability.

Strategic Significance & Outlook

The collaboration between Factorial and Mitsui Kinzoku marks a vital milestone in the industrialization of solid-state battery technology. Factorial's manufacturing approach, which maximizes the utilization of existing lithium-ion battery production infrastructure, combined with Mitsui Kinzoku's high-quality solid electrolyte technology, has the potential to accelerate the mass production and market introduction of solid-state batteries. If the targeted energy density of 450Wh/kg is achieved, it is expected to dramatically improve electric vehicle performance and bring about a significant transformation across the entire battery industry.

Source: <https://carboncredits.com/factorial-energy-fac-teams-up-with-mitsui-kinzoku-to-scale-solid-state-batteries/>

Collected: September 26, 2026 | Automated Research System (Gemini API)

#13 CATL: All-solid-state battery production timeline for 2027

Published September 19, 2026 Pandaily China



OVERVIEW

CATL aims for small-batch production of all-solid-state batteries by 2027, though current technology remains at TRL-4 (laboratory principle verification). Sulfide solid electrolytes, being moisture-sensitive and potentially generating hydrogen sulfide, necessitate ultra-dry production lines, making existing wet-process liquid electrolyte tools largely unusable. Unresolved process risks include solid-solid electrode interfaces, hot isostatic pressing yield, and dry electrode coating challenges.

Key Findings

CATL, the world's largest battery manufacturer, has set a target to commence small-batch production of all-solid-state batteries by 2027. However, the company's current solid-state battery technology is assessed at Technology Readiness Level 4 (TRL-4), indicating that it is still at the laboratory principle verification stage, with numerous technical challenges remaining before commercialization.

Technical Details

One of the primary technical hurdles CATL faces is related to the properties of sulfide solid electrolytes. While these electrolytes offer excellent ionic conductivity, they are highly sensitive to moisture and can produce toxic hydrogen sulfide gas upon contact with water. This characteristic means that most existing wet-process liquid electrolyte tools used in conventional lithium-ion battery manufacturing cannot be reused. Instead, dedicated production lines capable of maintaining ultra-dry environments are essential, leading to increased capital investment and manufacturing complexity.

Furthermore, several unresolved process risks have been identified:

- **Solid-solid electrode interface challenges:** It remains difficult to establish technologies that reduce interfacial resistance between electrodes and solid electrolytes and maintain stable contact over long periods.
- **Hot Isostatic Pressing (HIP) yield:** The yield of the HIP process, which is critical for uniformly forming solid electrolyte and electrode materials, is currently low, potentially leading to higher costs.
- **Dry electrode coating challenges:** Dry coating technology, which uniformly applies electrode materials without liquids, offers environmental benefits but presents significant technical difficulties in achieving consistency and performance.

Background & Context

All-solid-state batteries are considered the ultimate form of next-generation batteries due to their advantages in safety, high energy density, and long lifespan. The focus of major companies like CATL on this sector could shape the future of the EV market. However, the announced TRL level and specific challenges highlight that commercializing solid-state batteries remains technically complex and requires substantial R&D investment.

Strategic Significance & Outlook

For CATL to achieve its 2027 small-batch production target, it must rapidly resolve the material science and manufacturing process challenges outlined above. Key areas of focus will be moisture management, interface optimization, and improving production yields. Overcoming these hurdles will enable CATL to establish leadership in the solid-state battery market and contribute to the further advancement of the electric vehicle industry.

Source: <https://pandaily.com/catl-2027-all-solid-state-small-batch>

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#14 EV Battery Restoration: Chemical bath SEI removal method explained

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OVERVIEW

Scientists have developed a novel chemical bath method to restore degraded EV batteries without disassembly. This technique removes the solid electrolyte interphase (SEI) layer, a primary cause of lithium-ion battery capacity loss, by immersing the battery in a 1,3-dimethyl-2-imidazolidinone (DMI) bath. The process not only reverses SEI growth but also leaves a thin layer of lithium fluoride, which is expected to delay further SEI growth.

Key Findings

Scientists have developed a groundbreaking chemical bath method to restore the capacity of degraded electric vehicle (EV) batteries. This novel technique offers an efficient way to rejuvenate battery performance without requiring physical disassembly of the battery pack.

Technical Details

The new chemical bath method specifically targets the solid electrolyte interphase (SEI) layer, which is a primary culprit behind the gradual capacity loss in lithium-ion batteries. Over hundreds of charge-discharge cycles, the SEI layer accumulates on electrode surfaces, impeding lithium-ion movement and consequently reducing battery capacity. This method involves immersing degraded batteries in a specialized chemical bath containing 1,3-dimethyl-2-imidazolidinone (DMI) to effectively remove the accumulated SEI layer.

Immersion in the DMI bath causes the unwanted SEI layer to shed from the electrode surface, thereby restoring the free movement of lithium ions. Furthermore, the process is not merely a reversal of SEI growth; it has been shown to leave behind a thin, protective layer of lithium fluoride on the electrode surface. This lithium fluoride layer is anticipated to slow down future excessive SEI growth, potentially extending the battery's overall lifespan. This technology holds promise for circumventing expensive and time-consuming battery recycling processes, contributing to a more sustainable EV ecosystem.

Background & Context

With the widespread adoption of electric vehicles, the management and recycling of end-of-life batteries have become pressing concerns. Degraded batteries pose environmental challenges and represent a loss of valuable resources. Previous battery restoration techniques often involved disassembly or complex chemical treatments, presenting challenges in terms of cost and efficiency. The newly developed chemical bath method offers a potentially low-cost and efficient solution to these issues, with the potential to significantly extend battery lifecycles.

Strategic Significance & Outlook

This chemical bath method is hailed as a transformative technology for giving EV batteries a 'second life.' By extending the useful life of degraded EV batteries and delaying the need for new replacements, it can reduce the total cost of ownership (TCO) for EVs and enhance their sustainability. Future efforts will focus on further optimizing this technology, verifying its applicability to various battery chemistries, and scaling it up for broad commercialization. It promises to open new avenues for battery recycling and reuse, contributing significantly to the circular economy.

Source: <https://www.goodnewsnetwork.org/scientists-pioneer-chemical-bath-method-to-restore-aging-ev-batteries-without-breaking-them-down/>

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