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FINAL AGENDA

AUGUST 13-15, 2024 | CHICAGO, IL + VIRTUAL

# SOLID-STATE BATTERY SUMMIT

Reducing Costs and Achieving Safe, High Energy Density Batteries with Solid Electrolytes

## SODIUM-ION BATTERY CONFERENCE

## LITHIUM-SULFUR BATTERY SEMINAR

AUGUST 13-14, 2024

AUGUST 15, 2024

### 2024 Featured Speakers:



**Mei Cai**  
General Motors



**Cheng-Chieh Chao, PhD**  
QuantumScape



**Chisu Kim, PhD**  
Hydro-Quebec



**Shirley Meng, PhD**  
University of Chicago/Argonne National Laboratory



**Ilias Belharouk, PhD**  
Oak Ridge National Laboratory



**Christopher Johnson, PhD**  
Argonne National Laboratory



**David Mitlin, PhD**  
University of Texas Austin



**Colin Wessells**  
Natron Energy



**Vibha Kalra, PhD**  
Cornell University



**Ping Liu, PhD**  
University of California, San Diego



**Celina Mikolajczak**  
Lyten



**John Wood**  
Gellion

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## TUESDAY, AUGUST 13

7:30 am Registration and Morning Coffee

8:50 Organizer's Opening Remarks

### OEM PERSPECTIVES ON SOLID-STATE

8:55 Chairperson's Remarks

*Tobias Glossmann, Principal Systems Engineer, HV Battery Research and Test Lab, Mercedes-Benz Research and Development North America*

9:00 GM Solid-State Battery: Recent Advances and Prospects

*Mei Cai, Director, Battery Cell Systems Research Lab, General Motors Global R&D Center*

Solid-state battery represents a promising future battery technology, owing to its merits in abuse tolerance, operable temperature ranges, and system integration. There are still technical barriers that hinder their practical application, such as poor interfacial electrochemical compatibility. In this talk, we will discuss different types of solid electrolytes and propose the strategies to effectively enhance the interfacial compatibility and prolong cell cycling stability, with targets on multiple GM vehicle applications.

9:30 Solid-State Battery Prototypes for Automotive Applications

*Celia Cunningham, Research Engineer, Ford*

Solid-state battery technology has great potential, but we need to understand how cell chemistry and cell mechanics affect battery performance in cars. This talk will explore solid-state battery development for automotive applications, including key milestones, performance tests, diagnostic tests, and failure modes.

10:00 Unveiling Next-Gen Battery Chemistries in the Automotive Industry

*Ramin Rojaee, Advanced Battery Cell Technologist, Stellantis*

This presentation highlights future technologies, including Solid-State Batteries (SSB), Sodium-ion (Na-ion), and Lithium-Sulfur (Li-S), which Stellantis is actively exploring, and assesses the challenges and opportunities of these advancements. Each technology is being investigated for its feasibility in meeting and exceeding a diverse range of customer needs, with a distinct focus on long-term sustainability goals.

10:30 Networking Coffee Break

11:00 The Path towards Enabling Highly Performing Solid-State Batteries

*Rana Mohtadi, PhD, Senior Principal Scientist, Materials Research, Toyota Research Institute of North America*

Solid-state electrolyte (SSE) materials hold the key to enabling highly efficient solid-state battery technologies. Thus, the demonstration of SSEs capable of meeting the performance demand metrics is of a paramount importance. Herein, we will provide an update related to progresses being made in the area of SSE materials.

11:30 Potentials & Challenges of Solid-State Batteries for Automotive Applications

*Julian Bigi, PhD, Senior Battery Technology Engineer, Battery Engineering, BMW Group*

12:00 pm Sponsored Presentation (Opportunity Available)

12:30 Enjoy Lunch on Your Own

### OEM PERSPECTIVES ON SOLID-STATE

1:55 Chairperson's Remarks

*Rana Mohtadi, PhD, Senior Principal Scientist, Materials Research, Toyota Research Institute of North America*

2:00 Lithium Metal—A Unique Anode Worthy of Special Attention

*Tobias Glossmann, Principal Systems Engineer, HV Battery Research and Test Lab, Mercedes-Benz Research and Development North America*

An increased number of battery types are expected to use Li-metal anode technology in the coming years. They are attractive for energy density and enable more choices of positive electrode materials. Stake holders from industry and academia came together to identify open questions and serious challenges that must be addressed to enable successful integration. This talk will summarize these activities and highlight important issues to consider when testing Li-metal cells.

### APPLICATIONS & MARKET

2:30 Solid-State Batteries: A Springboard to a Carbon-Free Future

*Halle Cheesman, PhD, Program Director, Advanced Research Program Agency, U.S. Department of Energy (ARPA-E)*

Solid-state batteries are getting close to serious consideration for automotive applications, but for the most part the cathode chemistries to be utilized will be those that have been well proven in lithium-ion. High energy cathodes coupled with lithium anodes are the ultimate destiny for solid-state technologies, because they will deliver energy densities that exceed 500 Wh/Kg and may even attain 1,000 Wh/Kg. This presentation will explore these opportunities.

3:00 Grand Opening Networking Refreshment Break in the Exhibit Hall with Poster Viewing

3:45 Developing Low Cost and High Energy Density Solid-State Batteries

*Fudong Han, PhD, Assistant Professor & Priti & Mukesh Chatter Chair, Mechanical & Aerospace & Nuclear Engineering, Rensselaer Polytechnic Institute*

Conversion-type cathodes such as iron fluorides are a promising alternative for low-cost and high-energy-density batteries, but their practical application has been hindered by multiple challenges including large voltage hysteresis and cycling instability. We will introduce our recent work in addressing these challenges by "solidifying" iron fluoride cathodes with solid electrolytes. We will also present our recent work on the electronic conductivity of solid electrolytes and its implications for solid-state-battery development.

4:15 PANEL DISCUSSION: Overcoming the Obstacles to Widespread Commercialization of Solid-State Batteries

*Moderator: Shirley Meng, PhD, Professor, University of Chicago; Chief Scientist, Argonne Collaborative Center for Energy Storage Science, Argonne National Laboratory*

On the journey toward full market adoption of solid-state batteries for electric vehicle (EV) applications, numerous hurdles stand in the way, including cost, performance, manufacturability, and supply chain complexities. Join our panel of experts, representing diverse perspectives with global insights as they discuss the realities of the challenges and the strategies for the solutions that will achieve transformative market adoption.

5:15 Welcome Reception in the Exhibit Hall with Poster Viewing

6:15 Close of Day

## WEDNESDAY, AUGUST 14

8:00 am Registration and Morning Coffee



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## R&D ADVANCEMENTS IN SOLID-STATE BATTERIES

### 8:55 Chairperson's Remarks

*Adrian Tylim, Head Business Development North America, Blue Solutions*

### 9:00 Anode-Free Lithium Metal Batteries at QuantumScape

*Cheng-Chieh Chao, PhD, Vice President, R&D, Quantscape*

In this talk, QuantumScape's Vice President of Cathode, Cheng-Chieh Chao, will highlight recent developments in solid-state lithium-metal technology and review some of the challenges in transitioning from research and development to a commercial product.

### 9:30 Tackling Key Challenges of Lithium-Metal Anode for Next-Generation Solid-State Batteries

*Chisu Kim, PhD, Director of Research and Strategy, Hydro-Quebec*

Lithium metal is an attractive anode material, providing the highest gravimetric energy density possible. However, the current price of lithium-metal anode is far from meeting market requirements. Moreover, the fragility of thin lithium-metal foil limits the form factor of cell design and the cell manufacturing process. This presentation will introduce the new lithium-metal anode developed by Hydro-Quebec, which offers greater design flexibility at a significantly lower price.

### 10:00 New Perspective on Anode-Free All-Solid-State Batteries

*Shirley Meng, PhD, Professor, University of Chicago; Chief Scientist, Argonne Collaborative Center for Energy Storage Science, Argonne National Laboratory*

Anode-free strategy is gaining more interest in recent years, due to its manufacturing simplicity and potential for high-energy-density battery without safety compromise. However, the design constraints for anode-free batteries have been difficult to overcome. In this talk, I will give an update on our efforts to enable anode-free lithium-metal and anode-free sodium-metal batteries. We hope to discuss a few opportunities presented by such a strategy.

### 10:30 Coffee Break in the Exhibit Hall with Poster Viewing

### 11:00 All-Climate Fast-Charging Solid-State Batteries: A Path to Overcome EV Adoption Barriers

*Hui Du, PhD, CTO, Ampcera*

Road vehicles account for 25% of global carbon emissions; electric vehicles (EVs) reduce this carbon footprint by 40%. While EVs continue to grow their market share, the adoption rate has been lower than expected due to barriers like charging time, driving range, safety, climate restraints, and cost. Ampcera will showcase its all-climate fast-charging solid-state battery technology through materials innovation, cell engineering, and scalable manufacturing to accelerate the adoption of EVs.

### 11:30 Progress and Challenges in Composite Solid-State Electrolytes

*Dee Strand, PhD, CSO, R&D, Wildcat Discovery Technologies, Inc.*

Solid ion conductors require both high ionic conductivity and good processing/interfacial properties. Composite materials can combine the properties of fast ion-conducting ceramics with the good processability of polymers. This presentation will show current results for these materials integrated into all-solid-state batteries. Similar challenges exist for composite materials compared to other solid electrolytes in terms of stability at both the cathode and the anode, which will be reviewed.

### 12:30 pm Enjoy Lunch on Your Own

## R&D ADVANCEMENTS IN SOLID-STATE BATTERIES

### 1:55 Chairperson's Remarks

*Dee Strand, PhD, CSO, R&D, Wildcat Discovery Technologies, Inc.*

### 2:00 Progress on Our Gen4 SSB Chemistry on Three Different Cathode Materials (NMC, LFP, LMFP)

*Adrian Tylim, Head Business Development North America, Blue Solutions*

For over a decade, Blue Solutions has proven that solid-state batteries can be manufactured and successfully used in vehicle and stationary applications. This year, we'll present developments in our 4th generation chemistry and cell design as well as advancements in ultra-thin lithium-metal anode production.

### 2:30 The Use of Solid Electrolytes in High-Energy-Density Lithium-Metal Batteries Including Lithium-Sulfur, All-Solid-State, and Hybrid Batteries

*Steven Visco, PhD, CEO & CTO, PolyPlus Battery*

Solid electrolytes are enabling for high-energy-density lithium-metal battery technologies including lithium/metal-oxide, lithium/metal-phosphate, and lithium/sulfur. Batteries can be structured as hybrid cell structures or fully solid-state cells. High-volume/low-cost manufacturing of the solid electrolyte must be taken into consideration if the technology is to become commercially viable. Herein we look at the advantages and disadvantages of these various approaches and how it may affect scaling of the technology.

### 3:00 Advanced Batteries to Decarbonize Transportation

*Mohammad Asadi, PhD, Assistant Professor, Illinois Institute of Technology*

In this summit, I will present our recently developed cost-effective and energy-efficient solid-state air-battery technologies with superior energy density as a potential to defossilize heavy transport sectors such as heavy ground transportation, aviation, and maritime shipping.

### 3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

### 4:00 Multifunctional Coatings on Sulfide Solid Electrolyte Powders for Enhanced Processability and Performance

*Justin Connell, PhD, Materials Scientist, Materials Science, Argonne National Lab*

Despite significant promise, widespread adoption of sulfide solid-state electrolytes (SSEs) is hindered by processability in manufacturing environments and by lower performance and lifetime due to (electro)chemical instability at extreme potentials. We have developed atomic layer deposition-based ultrathin coatings on sulfide SSE powders that stabilize them to oxidizing atmospheres while significantly improving their electrochemical performance. This strategy enables a new, scalable framework for designing sulfide SSEs for next-generation solid-state batteries.

### 4:30 Halide-Cased All-Solid-State Batteries

*Fengyu Shen, PhD, Project Scientist, Solid Oxide Fuel/Electrolysis Cell, Solid State Battery, Lawrence Berkeley National Lab*

Halide-based batteries gain significant attention due to the low processing temperature, good formability, and so on. In this talk, button cells were studied with stack pressure, temperature, and CAM loading. Higher than 180 mAh/g discharge capacity was achieved with a high cathode loading and CAM ratio of 85% at room temperature. Pouch cells were also manufactured with electrolyte and electrode scaling-up using tape casting processes.

### 5:00 Session Break and Transition to Tutorial

### 6:45 Close of Day

THURSDAY, AUGUST 15

### 8:30 am Registration and Morning Coffee

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## APPLICATIONS & MARKET

### 8:55 Chairperson's Remarks

*Alex Bates, PhD, Energy Storage Safety & Reliability, Sandia National Laboratories*

### 9:00 Solid-State Battery Technology: A Journey through Development and Achievements in the Past & Outlook on Future Market Potentials and Remaining Challenges

*Ines Miller, Team Lead Battery Cells, E Mobility, P3 Automotive GmbH*

Increasing demand for more powerful batteries are pushing current Li-ion technology to its limits. Recent developments are attracting high media attention, and cell manufacturers are working on the realization and implementation of the next battery technologies. The presentation will evaluate the market readiness and competitiveness of solid-state batteries in comparison to other next-gen solutions; e.g., high silicon anodes with respect to performance, safety, scalability, and cost aspects.

## R&D ADVANCEMENTS IN SOLID-STATE BATTERIES

### 9:30 Processing Ceramic Structures for Solid-State Batteries

*Michael Tucker, PhD, Staff Scientist, Lawrence Berkeley National Lab*

This talk will focus on the design and optimization of processing approaches to fabricate the entire cell, with special attention to development of LLZO ceramic structures. Tape casting, freeze tape casting, phase inversion casting, texturing, and other processing approaches will be described in detail.

### 10:00 Achieving Extreme High Ion-Current Densities in Tailored Materials, Structures, and Interfaces

*Eric Wachsmann, PhD, Professor & Director, Materials Science & Engineering, University of Maryland College Park*

Solid-state batteries have the potential to be a transformational energy storage solution due to their non-flammable ceramic electrolyte and use of high-capacity metal anodes and high voltage cathodes. We developed tailored solid-state materials, structures, and interfaces that enable extreme high-current densities of 100 mA/cm<sup>2</sup> and 30 mA/cm<sup>2</sup> with Li-metal and Na-metal anodes, respectively, at room temperature with no applied pressure. These and full-cell results will be presented.

### 10:30 Networking Coffee Break in the Exhibit Hall with Poster Viewing

### 11:00 Solid-State Batteries: The Critical Role of Mechanics

*Andrew Westover, PhD, Staff Research Scientist, Energy Storage, Oak Ridge National Lab*

Solid-state batteries (SSB) with lithium metal anodes have the potential for higher energy density, charging rate, and improved safety. While often overlooked, SSB performance and failure are dictated by the evolution of stress and strain. This talk will reframe solid-state battery operation from a mechanics context. Using this mechanics lens, we will explore the stress and strain that result from battery cycling and the associated mechanisms for stress relief.

### 11:30 Making Pressure Irrelevant in Solid-State Batteries

*Kevin Wujcik, PhD, CTO, R&D, Blue Current Inc.*

This presentation provides a detailed exploration of Blue Current's pouch cell performance capabilities, focusing specifically on low-pressure operation that is key for commercialization of fully dry cells. The presentation will outline Blue Current's roadmap for cell production, highlighting aspects of the innovative process implemented at the company's 1-2 MWh pilot facility in Hayward.

### 12:00 pm Sponsored Presentation (Opportunity Available)

### 12:30 Enjoy Lunch on Your Own

## R&D ADVANCEMENTS IN SOLID-STATE BATTERIES

### 1:25 Chairperson's Remarks

*Ines Miller, Team Lead Battery Cells, E Mobility, P3 Automotive GmbH*

### 1:30 Stable Anode-Free All-Solid-State Lithium Battery through Tuned Metal Wetting on the Copper Current Collector

*David Mitlin, PhD, David Allen Cockrell Professor in Engineering, University of Texas Austin*

This presentation provides case studies derived from the group's LMB, NMB, and KMB liquid and solid-state research on the microstructural design principles that provide for long-term cycling and fast-charge stability of metal anodes. The wetting behavior of the electrolyte on the anode must be optimized, the wetting/stripping behavior of the metal anode on the current collector must be controlled, and a geometrically and chemically modified SEI must be established.

## SOLID-STATE BATTERY SAFETY

### 2:00 Are Solid-State Batteries Safer than Lithium-ion Batteries?

*Alex Yu, PhD, Founder and CTO, Factorial Energy*

Safety and performance are two key ingredients that make solid-state batteries so attractive for OEMs to use as a next-generation battery solution. This talk will dive into the reality of how safe solid-state batteries are compared to current lithium-ion batteries. The presentation will share real data from safety tests and take a deeper look into the cell chemistry that contributes to safety factors from the material to the pack level.

### 2:30 Networking Refreshment Break in the Exhibit Hall & Last Chance for Poster Viewing

### 3:00 Safer Quasi-Solid-State and Ultralow Temperature Li-ion Batteries

*Vilas Pol, PhD, Professor, Chemical Engineering, ViPER, Purdue University*

This Purdue University talk will emphasize scientific adventure on identifying anodes, cathodes, binders, ion conductive ceramics, salts, and fire suppressing molecules as well as understanding their fundamental interplay to make semi-solid-state Li-ion batteries inherently safer. Our recent exertions on making Li-ion batteries that are NOT prone to thermal, mechanical, and electrical abuse will be showcased.

### 3:30 Solid-State Battery Safety—Examination across Material Sets

*Alex Bates, PhD, Energy Storage Safety & Reliability, Sandia National Laboratories*

Solid-state battery technology still faces key challenges, including achieving necessary performance metrics in production-ready cells and manufacturability at relevant scales. To tackle these challenges, a wide range of materials have been, and continue to be, investigated. This talk will discuss the safety implications of the most promising materials, and dive into safety through the lens of materials-level testing and modeling.

### 4:00 Assessing Safety in the Early Stages: A Preliminary Analysis of Solid-State Battery Safety Features

*Alvin Wu, Research Manager, Commercial & Industrial R&D, UL LLC*

In this presentation, we explore the safety features of solid-state batteries, an emerging technology in energy storage. Although still in early stages, our research contributes to understanding solid-state battery safety and highlights critical areas needing further investigation and improvement to support next-generation battery technology.

### 4:30 Close of Conference

## TUESDAY, AUGUST 13

7:30 am Registration and Morning Coffee

8:50 Organizer's Opening Remarks

### SODIUM-ION BATTERY SUPPLY CHAIN

8:55 Chairperson's Remarks

*Robert Stanek, Global Advisor, Business Strategy & Alternative Powertrains, P3 Automotive GmbH*

**9:00 Sodium, the Savior of the Battery Material Supply Chain: Is It Capable of Replacing Li-ion-Based Battery-Cell Technologies in the Automotive Industry?**

*Robert Stanek, Global Advisor, Business Strategy & Alternative Powertrains, P3 Automotive GmbH*

**9:30 Sodium-ion Batteries: Competitive Landscape, Market Opportunities, and Challenges**

*Colin Wessells, CEO, Natron Energy*

This presentation introduces the leading classes of sodium-ion cells and compares their materials platforms and device performance to one another and to incumbent lithium-ion technologies. The major opportunities for performance and cost improvements—as well as the challenges and limitations on the technologies—will also be addressed. This presentation will conclude with an analysis of the relevant markets for each class of sodium-ion cells.

**10:00 Battery Energy Storage Supply Chain: Trends, Risks, and Recommendations**

*Kevin Shang, Senior Research Analyst, Battery and Energy Storage Technology and Supply Chain, Wood Mackenzie*

Grid energy storage is on a rapid growth curve and is already a key component of building a resilient grid that accommodates increasing renewables. However, supply chain issues have become a barrier, constraining energy-storage deployment. This talk will also explore the supply challenges and market opportunities that arise while establishing secure and sustainable supply chains for energy storage, taking into account government energy policy, legislation, and decarbonization strategy.

10:30 Networking Coffee Break

**11:00 Characterization of the Design and Performance of Commercialized Sodium-ion Batteries**

*Hayley Hirsh, PhD, Senior Engineer, Polymer Science and Materials Chemistry, Exponent*

The cell design and construction will be analyzed using 3D X-ray-computed tomography and cell teardowns with materials analysis. In addition, the electrochemical performance of these cells will be investigated over a range of rates and temperatures. This study will provide insight into the quality and performance of some of the early-to-market commercialized NIBs and how it could affect their use in large-scale energy storage.

**11:30 Sustainability and Sodium-ion Batteries**

*Emma Kendrick, PhD, Professor & Chair of Energy, Energy Materials Group, University of Birmingham*

Sodium-ion batteries have recently emerged as alternatives to lithium-ion batteries for low-range vehicles, stationary energy storage, and even power tool applications. In this work, the development of a sodium-ion battery and tear-down results from a 18650 containing a layered oxide cathode and hard carbon are discussed concerning its current state-of-the-art, potential application, and future optimization.

12:00 pm Sponsored Presentation (Opportunity Available)

12:30 Enjoy Lunch on Your Own

### SODIUM BATTERY SAFETY

1:55 Chairperson's Remarks

*Colin Wessells, CEO, Natron Energy*

**2:00 Ultrafast Na-ion Storage in Disordered Carbon Sheets, Optimized Cathodes, and Thermal Safety Aspects**

*Vilas Pol, PhD, Professor, Chemical Engineering, ViPER, Purdue University*

This talk will emphasize scientific adventure in developing various disordered carbon sheets and spheres for superior Na-ion storage. Detailed electrochemical characterizations proved that high specific capacities and rate performances are resulting from the synergetic effect of pseudocapacitive and intercalation Na-ion storage processes. *In situ* thermal safety aspects are studied utilizing multimodule calorimetry and will be discussed.

**2:30 Safe Electrolytes Na-ion Batteries**

*Phung Le, PhD, Scientist, Electrochemical Materials and Systems, Pacific Northwest National Laboratory*

This talk will discuss the ultralow-concentration electrolyte that is proposed for Na-ion batteries to further reduce the cost and expand the working temperature range.

**3:00 Grand Opening Networking Refreshment Break in the Exhibit Hall with Poster Viewing**

### ELECTRODES

**3:45 Anodes for Sodium-ion Batteries Based on Tin-Germanium-Antimony Alloys**

*David Mitlin, PhD, David Allen Cockrell Professor in Engineering, University of Texas Austin*

Here we provide the first report on several compositions of ternary Sn-Ge-Sb thin film alloys for application as sodium-ion battery (SIB) anodes. Several alloys demonstrate promising electrochemical behavior, with Sn<sub>50</sub>Ge<sub>25</sub>Sb<sub>25</sub> being the best overall. HRTEM shows that Sn<sub>50</sub>Ge<sub>25</sub>Sb<sub>25</sub> is a composite of 10-15nm Sn and Sn-alloyed Ge nanocrystallites that are densely dispersed within an amorphous matrix.

**4:15 Advanced Electrode Materials for Sodium-ion Batteries**

*Christopher S. Johnson, PhD, Senior Chemist & Argonne Distinguished Fellow, Chemical Sciences & Engineering, Argonne National Laboratory*

The improvement in electrode performance properties of layered sodium transition metal oxide cathodes from baseline NaNi<sub>1/3</sub>Mn<sub>1/3</sub>Fe<sub>1/3</sub>O<sub>2</sub> (NMF) to advanced materials will be reported. Through a combination of layer stacking P-type perturbations, precise Na/Mn ratios, selected dopings, and intergrowths, a new class of stable high-SOC materials with layered orientation relationships has been produced. These advanced cathodes are slated towards increasing sodium-ion battery energy densities to >160 Wh/kg in pouch cells.

**4:45 Structure Stabilization in Layered Transition Metal Oxide Positive Electrodes for Sodium-ion Batteries**

*Hui Claire Xiong, PhD, Associate Professor, Materials Science & Engineering, Boise State University*

Our recent progress in stabilizing layered transition metal oxide positive electrode structures during cycling and the origin of the phase interface's influence on the Na<sup>+</sup> storage and transport properties will be discussed. *In situ*/operando spectroscopic techniques used in our work to track the phase transitions will also be discussed.

5:15 Welcome Reception in the Exhibit Hall with Poster Viewing

6:15 Close of Day

# Program Agenda

August 13-14, 2024 • Chicago, IL

WEDNESDAY, AUGUST 14

8:00 am Registration and Morning Coffee

## ELECTRODES

8:55 Chairperson's Remarks

Hayley Hirsh, PhD, Senior Engineer, Polymer Science and Materials Chemistry, Exponent

9:00 Opportunities and Challenges in Anode-Free Sodium Batteries Enabled by Nonporous Sodium-Metal Plating in Liquid Electrolytes

Peng Bai, Assistant Professor, Energy & Environmental & Chemical Engineering, Washington University

Stable alkali-metal batteries offer much higher energy densities than their alkali-ion counterparts, at lowered costs and reduced resources. However, metal dendrites and solid-electrolyte interphase (SEI) layers undermine the battery safety and cycle life. In this talk, we will introduce the ideally reversible nonporous ingot-type sodium-metal plating in the "correct" liquid electrolytes, the feasibility of practical anode-free sodium batteries, and the remaining challenges toward commercialization.

9:30 Electrodes in Sodium Batteries

Shinichi Komaba, PhD, Professor, Tokyo University of Science

Here, the sodium storage mechanism in commercial-grade hard carbon with a low surface area is comprehensively investigated using electrochemical impedance spectroscopy (EIS).

10:00 Chalcocarbogels as High-Capacity and Cycle-Stable Electrode Materials for Lithium- and Sodium-ion Batteries

Ilias Belharouak, PhD, Section Head, Electrification and Energy Infrastructure Division, Oak Ridge National Laboratory

This talk explores the potential of chalcocarbogels as advanced electrode materials in lithium and sodium-ion batteries. We delve into their high-capacity characteristics and exceptional cycle stability, shedding light on their promising role in future energy storage technologies.

10:30 Coffee Break in the Exhibit Hall with Poster Viewing

11:00 Development of High-Energy and Long-Life Sodium-ion Batteries

Gui-Liang Xu, Chemist, Chemical Sciences & Engineering, Argonne National Laboratory

In this talk, I will introduce the development of advanced layered oxide cathodes and high-capacity phosphorus anodes at Argonne National Laboratory, aiming to develop advanced sodium-ion batteries with high cell-energy density of >200 Wh/kg. I will also discuss the underlying mechanism behind the structural design using multiscale *in situ* synchrotron X-ray and microscopy characterization.

11:30 Commercializing Ultra-Low-Cost Sodium-ion Battery Materials

Spencer Gore, Co-Founder and CEO, Bedrock Materials

The mission of Bedrock Materials is to develop, commercialize, and scale ultra-low-cost sodium-ion battery materials for use in automobiles. Sodium-ion batteries offer most of the performance of lithium-ion, but with less reliance on critical minerals like cobalt, copper, graphite, lithium, and nickel.

12:00 pm Sponsored Presentation (Opportunity Available)

12:30 Enjoy Lunch on Your Own

## DEVELOPMENT

1:55 Chairperson's Remarks

Spencer Gore, Co-Founder and CEO, Bedrock Materials

2:00 Development of Sodium-ion Cells Containing Prussian White Cathode: From Material Properties to Upscaled Cell Prototypes

Ivana Hasa, PhD, Assistant Professor, Electrochemistry for Batteries, University of Warwick

This presentation gives an overview of the journey toward the development of Prussian White containing 1Ah sodium-ion cells, highlighting the importance of a comprehensive understanding of the material properties and their processability for a successful transition from lab-scale to upscaled cell prototypes.

2:30 Ball Milling-Enabled Fe<sub>2.4+</sub> to Fe<sub>3+</sub> Redox Reaction in Prussian Blue Materials for Long-Life Aqueous Sodium-ion Batteries

Zhenxing Feng, Assistant Professor, Chemical Engineering, Oregon State University

Aqueous Na-ion batteries using Prussian Blue materials have inherent advantages in safety, material sustainability, and economic cost. However, it is challenging to obtain long-term cycling stability because many redox reactions have poor intrinsic stability in water.

3:00 Nuclear Magnetic Resonance Investigations of Ion Transport in Sodium Electrolytes

Steven G. Greenbaum, Professor, Physics & Astronomy, Hunter College, City University of New York

Research into sodium-based batteries grows due to cost advantages. NMR spectroscopy, like <sup>23</sup>Na NMR, characterizes ion transport in sodium electrolytes. Challenges include broad resonances from <sup>23</sup>Na's large quadrupole moment. Nonetheless, PFGD successfully studies cation and anion transport, revealing transference numbers and ion pairing in Na-electrolyte systems.

3:30 Refreshment Break in the Exhibit Hall with Poster Viewing

4:00 PANEL DISCUSSION: Advantages and Challenges of Sodium-ion Batteries: The Future of Sodium-ion Batteries

Moderator: Hayley Hirsh, PhD, Senior Engineer, Polymer Science and Materials Chemistry, Exponent

Panelists:

Colin Wessells, CEO, Natron Energy

Spencer Gore, Co-Founder and CEO, Bedrock Materials

Robert Stanek, Global Advisor, Business Strategy & Alternative Powertrains, P3 Automotive GmbH

5:00 Session Break and Transition to Tutorial

6:45 Close of Day



August 15, 2024 · Chicago, IL

THURSDAY, AUGUST 15

8:30 am Registration and Morning Coffee

## R&D ADVANCEMENTS IN LITHIUM-SULFUR BATTERIES

8:55 Chairperson's Remarks

*Ratnakumar Bugga, PhD, Senior Fellow, Lyten*

9:00 Performance of Lyten's Cylindrical and Pouch Li-S Cells

*Celina Mikolajczak, Chief Battery Technology Officer, Lyten*

Combining its unique 3D graphene sulfur host with several advanced cell components, Lyten is developing next-generation Li-S cells with higher specific energy than Li-ion batteries. Lyten has begun manufacturing commercial cylindrical and pouch cells on semi-automatic assembly lines. We will present the performance of these cells and outline our roadmap for advancing Lyten's low-cost, high-energy, and green Li-S technology for EVs.

9:30 Lithium-Sulfur Batteries with Stabilized Electrodes and Interfaces

*Arumugam Manthiram, PhD, Professor, Mechanical Engineering, University of Texas at Austin*

The commercialization of lithium-sulfur batteries is hampered by the poor cycle life and low energy density of practical cells. To overcome these challenges, this presentation will focus on electrocatalyst-integrated sulfur or Li<sub>2</sub>S cathodes to enhance the electrochemical utilization as well as incorporation of additives into the cathode or electrolyte to stabilize lithium-metal plating and stripping, while maintaining the sulfur loading high and electrolyte/sulfur ratio low.

10:00 Stable Li-S Batteries Using 3D Li Anodes and Sulfurized Carbon

*Rodrigo Salvatierra, PhD, CSO, Zeta Energy*

Zeta Energy's technology has effectively addressed the primary issues preventing the commercialization of lithium-sulfur (LiS) batteries: dendrite formation and sulfur loss due to the polysulfide shuttle. This presentation will offer a comprehensive insight into our advanced anode and cathode technologies, showing how their synergy results in high-performance cells that fully leverage the inherent benefits of low-cost, sustainable, and accessible energy storage solutions.

10:30 Networking Coffee Break in the Exhibit Hall with Poster Viewing

11:00 High Energy Density and Fast Charging Lithium-Sulfur Batteries Enabled by Lithium-Metal Host Anode

*Aamir I. Waidha, PhD, Principal Battery Scientist, R&D, Theion GmbH*

Theion, a Berlin-based lithium-sulfur battery start-up, has developed a unique, direct crystal imprinting process for the fabrication of monoclinic, monolithic sulfur crystal cathode with more than 92 weight% of active sulfur and an areal capacity exceeding 12 mAh cm<sup>-2</sup>. Coupled together with the proprietary prelithiated lithium metal host anode, the resulting batteries are capable of reaching gravimetric energy density of 1000 Wh kg<sup>-1</sup> along with high cycle life.

11:30 Integrating Material Design, in-Operando Spectroscopy, and Electrochemical Study for Next-Generation Lithium-Sulfur Batteries

*Vibha Kalra, PhD, Fred H. Rhodes Professor, Smith School of Chemical and Biomolecular Engineering, Cornell University*

In this talk, I will present our group's research on integrating material design and fabrication, in-operando and postmortem spectroscopy, and device assembly and testing (coin/pouch) to study and develop next-generation lithium-sulfur batteries. I will discuss representative projects on studying cathode, anode, and electrolyte chemistries to mitigate challenges such as the polysulfide shuttle, low S/Li<sub>2</sub>S conductivity, and lithium dendrites.

12:00 pm Sponsored Presentation (Opportunity Available)

12:30 Enjoy Lunch on Your Own

## R&D ADVANCEMENTS IN LITHIUM-SULFUR BATTERIES [CONT.]

1:25 Chairperson's Remarks

*Celina Mikolajczak, Chief Battery Technology Officer, Lyten*

1:30 Solid-State Li-S Batteries: Progress in Materials, Processes, and Cell Design

*Holger Althues, PhD, Head, Chemical Surface Technology Group, Fraunhofer Institute for Material & Beam Technology*

Sulfidic solid-state electrolytes enable the efficient solid-solid conversion of sulfur and suppress any polysulfide diffusion in solid-state Li-S cells. Further, high-energy Li-S cells were built and evaluated utilizing a semi-solid concept. Based on those results, the talk will cover recent progress in materials, processes, and cell design for solid-state Li-S batteries.

2:00 Li-S: A Chemistry Ready for Scale-Up, Meeting Cost Challenges while Exceeding Performance Requirements

*Michael Liedtke, Chief Commercial Officer, Zeta Energy*

Zeta Energy developed a novel Li-sulfur battery technology which allows for smooth scaling-up and cutting the traditional supply chains. Process optimizations in the early stage of the product development drive manufacturing choices early on, which only Zeta's Li-S technology enables. Source local and produce local, while the market demand drives production location decision, in either North America or the EU or both. Local supply chains do support this strategy.

2:30 Networking Refreshment Break in the Exhibit Hall & Last Chance for Poster Viewing

## APPLICATIONS & THE PATH TO COMMERCIALIZATION

3:00 Making Lithium-Sulfur Real—Safety, Performance, Low Cost

*John Wood, CEO, Gelion*

Lithium-sulfur technology will make a great contribution to the energy transition. The abundance and energy density of sulfur is compelling. The technology has been gnarly but is being mastered quickly. Gelion is taking a different path. A path prospected by Oxis, clarified by Oxlid, and being refined by Gelion. All characteristics of safety, performance, and cost-effectiveness from the start. No compromise.

3:30 Development of Long-Life Li/SPAN Batteries

*Ping Liu, PhD, Professor and Director, Sustainable Power and Energy Center, University of California, San Diego*

The solid-solid conversion mechanism also makes cell performance less sensitive to electrolyte amount. SPAN has a limited capacity (~750 mAh/g-material). By understanding SPAN structure and reaction mechanisms, we have been able to increase sulfur content to offer specific capacities rivaling those of carbon-sulfur composites while preserving the solid conversion mechanism and cycle life.

4:00 PANEL DISCUSSION: Future of Li-S—Technology Options and Overcoming the Barriers to Commercialization

*Moderator: Celina Mikolajczak, Chief Battery Technology Officer, Lyten*

This panel discussion will explore conventional architecture (liquid electrolyte, elemental sulfur, and alternate sulfur compounds). In addition, quasi- or all-solid state systems—will they mature before the interest in Li-S dwindles—will be discussed. Non-Li-sulfur systems and when will it make an entry into the commercial market?

4:30 Close of Conference

August 14, 2024 | 5:15 - 6:45 PM • Chicago, IL



## TUT1: Battery Safety & Thermal Runaway

**Instructor:**

**Ahmad Pesaran, PhD, Chief Energy Storage Engineer, National Renewable Energy Laboratory**

Application of lithium-ion batteries (LIB) in electrified transportation and renewable grid is growing at a very fast pace for decarbonization of the passenger vehicles by 2035. Due to the characteristics of current LIB technologies, although rare, there is potential for thermal runaway and fires, as seen by recent fires in Tesla Model S, Chevy Bolt, and grid storage system in an Arizona Utility. Increased severity of fire incidents with more advanced energy-dense LIBs, especially cathodes with higher Ni, and anodes with silicon or lithium, is expected. In this tutorial/seminar we will: 1.) discuss fundamental causes for safety issues leading to thermal runaway and fire, 2.) review abusive behavior of cells and packs through characterization, testing, and modeling/simulations, 3.) provide overview of approaches that could reduce safety risks and detect impending failures, and 4.) provide references as a resource for accessing more information. This tutorial/seminar is provided by Dr. Ahmad Pesaran with 25+ years' experience in lithium-ion battery R&D including safety testing and modeling with perspectives of his participation at USABC Technical Advisory Committee. He will provide the audience with information and understanding needed to handle Li-ion battery safety in both their work at their companies and in products they deliver to the market.

### TOPICS TO BE COVERED:

- LIB Applications LIB Introduction
  - a. Battery Fundamentals
  - b. Battery Chemistries
  - c. Cell Designs LIB Safety and Abuse
- a. LIB Fires
  - b. Instigators for Thermal Runaway
  - c. Battery Abuse Characterization and Testing Equipment
  - d. Battery Abuse Modeling/Simulation Tools Approaches for Designing Safer Cells and Modules—Recent Progress of EV Pack and System SafetyRemarks on Safe Handling of LIBs Summary



## TUT2: Lithium Metal Anodes: Benefits and Challenges to Batteries

**Instructor:**

**Dee Strand, PhD, CSO, R&D, Wildcat Discovery Technologies, Inc.**

### TOPICS TO BE COVERED:

- Energy density improvements with lithium-metal anodes
- Key challenges: Formation of dendrites and high surface area lithium
- SEI Volume expansion during cycling
- Approaches to mitigate challenges
- Solid vs. liquid cells using lithium anodes
- "Anode-free" approaches



## PRESENT A POSTER & SAVE \$50

Cambridge EnerTech encourages attendees to gain further exposure by presenting their work in the poster sessions. To secure an onsite poster board and/or ensure your poster is included in conference materials, your submission must be received, and your registration paid in full, by **July 19, 2024**.

**Register** and indicate that you would like to present a poster. Once your registration has been fully processed, we will send an email with a unique link and instructions for submitting your materials. Please see below for more information.

### Reasons you should present your R&D findings at this conference:

- Your research will be seen by leaders from top commercial, academic, and government institutes
- Discuss your research and collaborate with interested attendees and speakers
- Your poster will be published in our conference materials
- Receive a \$50 discount off your Commercial or Academic/Government registration



## PREMIER SPONSOR

### Exhibition/Meeting Space & Delegate Passes

- 8' x 10' exhibit space
- Three (3) Main conference registrations in addition to the speaker (excludes tutorials)
- Two (2) booth staff registrations
- Additional full conference registrations available at a discount for your staff (Limited to 5)

### On Site/Enhanced Branding

- 30-minute presentation to all session attendees (live and virtual) as part of the main conference program
- Your choice of one of the following:
  - \_\_Tuesday or Thursday Lunch
  - \_\_Private Invitation-Only Dinner for 10-12 invited delegates plus 3 staff members
  - \_\_6 - 8-One-on-one meetings with selected prospects (20 minutes)
  - \_\_Keynote panel co-presenter (7-8 minutes)
  - \_\_Keynote intro (10 minutes) (Exclusive)
  - \_\_Battery Innovator Award
  - \_\_Hotel key cards (Exclusive)
  - \_\_Badge lanyards (Exclusive)
  - \_\_Tote bags (Exclusive)
  - \_\_Wi-Fi Co-Sponsor
  - \_\_Welcome Reception (Tuesday – Exclusive)
  - \_\_Foot trails carpet advertising
- Opportunity to host a break-out discussion table on the main conference program
- Banner ad in conference app
- Talk promoted in the final conference brochure, event web site, conference proceedings, program and exhibits guide and on-site signage highlighting your organization as a "Premier Sponsor"
- Corporate logo on the cover of the final conference brochure
- Corporate logo in the conference proceedings
- Corporate logo with link on the homepage of the event website
- 50-word company description in the Conference Materials
- On-site signage designating your company as a Premier sponsor
- Post conference attendee lists for one-time usage through a third-party mail house

## CORPORATE SPONSOR Agenda Presentation

### Exhibition/Meeting Space & Delegate Passes

- 8'x10' exhibit space
- Two (2) Main conference registrations (excludes tutorials)
- Complimentary registration for the speaker
- Two (2) booth staff registrations

### Thought Leadership & Branding

- 15- or 30-minute presentation to all session attendees (live and virtual) as part of the main conference program
- Talk promoted in the final conference brochure, event website, conference proceedings, conference materials, and onsite signage

## CORPORATE SPONSOR One-to-One Meetings

### Exhibition/Meeting Space & Delegate Passes

- One 8'x10' exhibit space

### Thought Leadership & Branding

- Small room for one-to-one meetings–Day and time to be determined
- CET will set up 6-8 one-to-one meetings and confirm attendance
- Sponsor (your company) will select invitees from the conference preregistration list
- CET will extend invitations, conduct follow-up, and monitor responses
- CET will place reminder cards in the badges of attendees onsite

**CONTINUED ON  
NEXT PAGE**



## CORPORATE SUPPORT

### Exhibition/Meeting Space & Delegate Passes

- One 8' x 10' exhibit space
- Exhibit space includes table, two chairs, and wastebasket. Additional furnishings and materials can be ordered through the event Contractor. Information for ordering will be provided in your exhibitor kit which will be available 8-10 weeks prior to the event.
- One (1) main conference registration—excludes access to tutorials and training seminars
- Additional main conference registrations available at a discount for your staff—limited to 5

### Thought Leadership & Branding

- The Corporate Support Sponsor will have the option to choose one of the following options:
- Coffee/Refreshment Break Sponsorship
- Floor-Standing Meter Board
- Poster Award Sponsorship
- Ad in the Program Materials
- Literature Distribution—"Chair Drop"
- One Additional Conference Registration

## ALL PROGRAMS MENTIONED ALSO INCLUDE:

- Corporate logo on the cover of the final conference brochure
- Corporate logo in the conference proceedings
- Corporate logo with link on the homepage of the event website
- 50-word company description in the Conference Materials
- Pre- & post-conference attendee lists for one-time usage through a third-party mail house
- On-site signage designating your company as a sponsor
- Conference discount email for your clients & prospects: Provide us your list and we can send an email on your behalf OR we will provide you with a discount code to send out on your own—a savings of up to \$200 will be offered

## ADDITIONAL OPPORTUNITIES INCLUDE:

- Exhibit Booth Space—[View Exhibit Contract](#)
- Conference Tote Bags (Exclusive—includes tote bag insert)
- Registration Area Sponsor (Exclusive)
- Double-sided Meter Board

## Contact Us for More Information:



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# Join Us in Chicago!



For hotel reservations, please go to the Travel page of [CambridgeEnerTech.com/solid-state-batteries](https://CambridgeEnerTech.com/solid-state-batteries)



## Conference Venue and Hotel:

InterContinental Chicago Magnificent Mile  
505 Michigan Ave  
Chicago, IL 60611  
Discounted Room Rate: \$219 s/d  
Discounted Room Rate Cut-off Date: July 5, 2024

Just beyond the InterContinental Chicago Magnificent Mile Hotel's front steps is the famed Magnificent Mile. Long popularized as the capital of upscale shopping, fashion boutiques, and chic urban finds, this bustling district is within walking distance of Navy Pier, the historic Chicago Water Tower, opulent Wrigley Building, Millennium Park, the Art Institute of Chicago, and scenic Michigan Avenue Bridge.

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