SAVE THE DATE!
MARCH 26-29 2018
FORT LAUDERDALE, FL

Cambridge EnerTech
A Division of Cambridge Innovation Institute

InternationalBatterySeminar.com

34th ANNUAL

International Battery SEMINAR & EXHIBIT

March 20-23, 2017
Fort Lauderdale Convention Center
Fort Lauderdale, FL

LONGEST RUNNING 34th ANNUAL BATTERY EVENT

ADVANCED BATTERY TECHNOLOGIES FOR CONSUMER, AUTOMOTIVE & MILITARY APPLICATIONS

CONFERENCE PROGRAMS:

R&D STREAM
- Next-Generation Battery Research
- Lithium-Ion Development & Commercialization

MANUFACTURING STREAM
- High Performance Battery Manufacturing
- Lithium-Ion Development & Commercialization

APPLICATIONS STREAM
- Advances in Automotive Power Applications
- Emerging Energy Storage Applications
- Power Applications for Consumer Electronics

ENGINEERING STREAM
- Battery Safety
- Battery Management Systems

PLENARY KEYNOTE PRESENTATIONS

Gigafactory Material Sourcing and Cell Production
Kurt Kelty,
Senior Director, Cell Supply Chain & Business Development, Tesla Motors

Surprising Chemistry in Li-Ion Cells
Jeff Dahn, Ph.D.,
Professor, Dalhousie University; NSERC/Tesla Canada Industrial Research Chair

Charging Forward: Explosive Global Growth in the Battery Industry – and Opportunities and Challenges Ahead
Christina Lampe-Onnerud, Ph.D., *CEO, Founder, Chairman, Cadenza Innovation, LLC; Founder, Boston Power*

Advances within the BYD EDV Program and Its Technology
Xi Shen, Ph.D.,
Senior Director and General Manager, BYD EDV Batteries, China

WenFeng Jiang, Ph.D.,
R&D General Manager, BYD EDV Batteries, China

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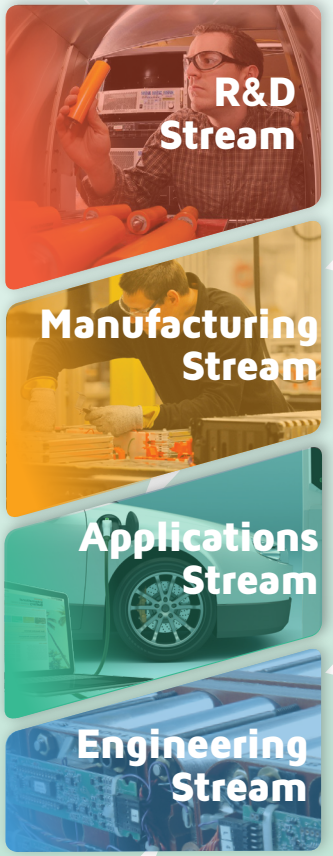
CONFERENCE AT A GLANCE



MONDAY	TUESDAY	WEDNESDAY	THURSDAY
TUTORIALS	Next-Generation Battery Research	PLENARY KEYNOTES	Lithium-Ion Development & Commercialization
	High Performance Battery Manufacturing		Lithium-Ion Development & Commercialization
	Advances in Automotive Power Applications		Emerging Energy Storage Applications
			Power Applications for Consumer Electronics
	Battery Safety		Battery Management Systems

TUTORIALS

MONDAY, MARCH 20, 2017*

8:00 - 10:00 AM

TUT1: Materials Selection and Design for Batteries with High Energy Density, Ultralong Cycle Life and Excellent Safety

Yi Cui, Ph.D., Associate Professor, Materials Science & Engineering, Stanford University

This tutorial gives an overview on the materials selection and design in order to increase the energy density of batteries, extend the cycle life and enhance the safety significantly. It targets the application from portable electronics, electric vehicles to grid-scale storage. Topics include 1) Si, Li metal, P Anodes and S Cathodes for high energy batteries, which offers 7-10 times higher lithium ion storage capacities; 2) Low cost Prussion-blue based materials and Li metal-polysulfide semiflow batteries for grid-scale storage; and 3) a novel idea of smart separator to enhance battery safety.

TUT2: Battery Safety Training

Shmuel De-Leon, CEO, Shmuel De-Leon Energy, Ltd.

Batteries have become daily use components for many applications. More than that, we can say that without batteries, our lives would change dramatically – just think of life with no mobile phones. In the race for energy density, we sometimes forget the safety. Unfortunately, we face daily safety events with injuries and severe damage. The workshop focuses on portable and stationary battery safety along battery cycle life (acceptance, testing, assembly, use, transportation and disposal). The training incorporates Shmuel De-Leon's and other experiences on battery safety representing over 25 years of work in the field. The motivation behind the training is to provide attendees with the knowledge needed to safely handle the batteries in their organization and to support reduction in safety events.

TUT3: Battery Technology Evaluation and Commercialization Strategies

Christopher M. Claxton, Senior Business Development Executive, Energy Storage, Argonne National Lab

This tutorial discusses the process involved in bringing your battery technology product or service to market. We will explore a research and development ecosystem that encompasses the development chain from materials to fabrication and diagnosis and performance evaluation. Examples of collaborations and partnerships will be presented. .

10:30 AM - 12:30 PM

TUT4: Technoeconomic Analysis of Battery Material Development and Manufacture

Thomas D. Gregory, Owner, Borealis Technology Solutions LLC

John E. Anderson, Economic Evaluator, The Dow Chemical Company

Successful commercialization of battery materials is achieved when technological feasibility, economic practicality, and market need intersect. Technoeconomic analysis methodology for evaluating these issues will be discussed, focusing on the critical early stages of a project where product design and process chemistry and development occur amid significant technical and economic uncertainty.

TUT5: Recent Advances in Solid State Electrolytes for Energy Storage

Jeff Sakamoto, Ph.D., Associate Professor, Department of Chemical Engineering and Material Science, Michigan State University

Josh Buettner-Garrett, CTO, SolidPower

Yifei Mo, Ph.D., Assistant Professor, University of Maryland

Dangerous liquid electrolytes are employed over solid electrolytes due to their high conductivities and excellent interfacial behavior. However, current research is narrowing the gap between liquid and solid electrolytes. This course will provide a review of advances in solid electrolyte, from material synthesis, to interfacial stability, to practical device applications.

TUT6: LIB Reuse & Recycle

Jeffrey Cunningham, Ph.D., Associate Professor, Department of Civil and Environmental Engineering, University of South Florida

Stefan Elsner, Head, Operations, GRS Batterien Service GmbH

Dirk Spiers, President, Spiers New Technologies

Experts during this tutorial explore the reuse and recycling of lithium-ion batteries, including the prospects of bioleaching for recovery of valuable metals from spent lithium-ion batteries and the European approach for end-of-life portable and industrial batteries.

TUT7: Advancements in Wireless Charging: Applications, Standards & Integration

James Kaschmitter, CEO and Founder, SpectraPower LLC

This tutorial will cover the latest advancements in wireless charging, applications, standards, testing & integration. This session will provide an overview of current market trends including standards (Qi, PMA, Airfuel) in addition the tutorial will cover induction & resonant approaches along with product solutions and typical applications.

** Separate registration required or All Access registration.*
See website for further Tutorial descriptions.

TUTORIALS

MONDAY, MARCH 20, 2017*

2:00 - 4:00 PM

TUT8: The Rechargeable Battery Market: Value Chain and Main Trends 2017 – 2027

Christophe Pillot, Ph.D., Battery Survey Manager, Avicenne Energy, France

This tutorial will present the 10 year automotive market forecasts from Avicenne and other analysts (micro|Hybrid|P-HEV|EV). Other coverage will include Car makers' strategies and Advanced Energy Storage (Advanced lead acid|Supercap|NiMH|LIB). Additionally LIB design for P-HEV & EV markets (Cylindrical, prismatic, pouch|Wounded, stacked, Z fold cells) and LIB cell, module & pack cost structure 2017-2027 will be discussed.

TUT9: Improving the Energy Density of Batteries with Silicon-Based Anodes

Dee Strand, Ph.D., CSO, Wildcat Discovery Technologies

This tutorial gives an overview on the benefits and challenges of using silicon-based anodes to improve the energy density of lithium ion batteries. Topics will include the key challenges in use of silicon based anodes as well as progress in implementation of silicon and what can we expect in the future. In addition, attendees will hear the latest improvements in other battery components required to maximize the benefit of silicon based anodes.

** Separate registration required or All Access registration.*
See website for further Tutorial descriptions.

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MARCH 21 - 22 | **R&D STREAM**

Next-Generation Battery Research

Advances in Material, Chemical, and Electrochemical Engineering

MONDAY, MARCH 20

7:00 am – 4:00 pm **Tutorial* Registration Open**

7:00 – 8:00 am **Morning Coffee**

8:00 – 4:00 **Pre-Conference Tutorials***

12:30 – 1:30 pm **Luncheon Presentation** *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

1:30 – 2:00 **Networking Refreshment Break**

*** See page 4 for Tutorial details. Separate registration required for Tutorials.**

TUESDAY, MARCH 21

7:30 am **Registration and Morning Coffee**

Increasing Energy Density with Alternative Chemistries

8:30 **Organizer's Opening Remarks**
Mary Ann Brown, Executive Director, Conferences, Cambridge EnerTech

8:35 **Chairperson's Remarks**
Brian J. Ingram, Ph.D., Materials Engineer, Chemical Science and Engineering Division, Joint Center for Energy Storage Research, Argonne National Laboratory

8:40 **Reversible Magnesium Chemistry in Nitrile and Carbonate Electrolytes**
Chunmei Ban, Ph.D., Senior Scientist, Center of Chemistry & Nanoscience, National Renewable Energy Laboratory (NREL)
The divalent feature of Mg anode brings high gravimetric and volumetric capacity, and the non-dendritic formation overcomes the major safety and performance challenges associated with Li anode. But the unique electrochemistry of Mg prohibits its reversible deposition in aprotic solvents (except ethers). We discuss a new strategy to modify the surface of Mg for facilitating the reversible deposition of Mg metal without interacting with the electrolyte. This enables the usage of the noncorrosive electrolytes for Mg-metal batteries.

9:10 **Multivalent Ion as the Next Energy Storage Frontier**
Brian J. Ingram, Ph.D., Materials Engineer, Chemical Science and Engineering Division, Joint Center for Energy Storage Research, Argonne National Laboratory
Non-aqueous multivalent (MV) intercalation batteries offer energy density limitations, cost, and safety improvements relative to state-of-the-art Li-ion battery technology. As an emerging field, there are specific scientific questions that must be answered before MV batteries are commercially available. A marriage of theoretical and experimental approaches helps to expedite this process within the Joint Center for Energy Storage Research (JCESR).

9:40 **FEATURED PRESENTATION: Breakthrough Energy Storage Programs at ARPA-E**
Susan Babinec, Senior Commercialization Advisor, ARPA-E, U.S. Department of Energy
ARPA-E forwards the goals of the Department of Energy by supporting the development and commercialization of high-risk/high-reward technologies that are often not otherwise funded. This talk presents our approach and the result of the first six years of efforts in energy storage.

10:10 **Networking Coffee Break**

Increasing Energy Density with Materials

10:45 **Magnetically Aligned Graphite Electrodes for High-Rate Performance Li-Ion Batteries**
Juliette Billaud, Ph.D., Postdoctoral Fellow, Energy Storage, Paul Scherrer Institut
Fast lithium-ion diffusion and thus fast rate capability in actual battery anode is impinged by the high tortuosity of the graphite and electrolyte phase. We used a magnetic alignment technology to control the orientation of graphite flakes in a battery anode to reduce its tortuosity. Decreasing the tortuosity allowed us to increase by three times the specific charge at C-rate in thick electrodes.

11:15 **In-Depth Investigation of Process-Structure-Property Relationship in the Cathode Materials**
Qi Liu, Ph.D., Research Scientist, X-Ray Division, Advanced Photon Source, Argonne National Laboratory
We center on the study of V2O5 as cathode materials for Li-ion batteries. We develop a method to incorporate graphene sheets into vanadium pentoxide nanoribbons via the sol-gel process. The resulting graphene-modified nanostructured vanadium pentoxide hybrids contain only 2 wt. % graphene, yet exhibit extraordinary electrochemical performance. Finally, the in-depth investigation of process-structure-property relationship in these hybrids-based Li-ion batteries has been studied using advanced *in situ* synchrotron techniques and existing tools.

11:45 **Nanocomposites as Next-Generation Anode Materials for Lithium-Ion Batteries**
Lorenzo Mangolini, Ph.D., Associate Professor, Mechanical Engineering Department, Materials Science and Engineering Program, University of California, Riverside
Silicon-based anodes for lithium-ion batteries have attracted increasing attention because of their high energy density. Still, there are many unresolved issues that have prevented the penetration of this material in commercial batteries. We have found that the addition of tin to the silicon-based anode structure provides great improvements in charge-discharge stability. We attribute this to the high electrical conductivity of tin, and to the capability of dispersing tin nanoparticles very uniformly in the anode structure.

Next-Generation Battery Research Continued

12:15 pm **Manufacturing Technology of All-Solid-State Thin-Film Li Battery for IoT Applications** *Sponsored By* ULVAC

Koukou Suu, Ph.D., ULVAC Fellow, General Manager, Global Marketing and Technology Strategy, ULVAC, Inc.

Solid-State Thin-Film Li secondary batteries have come to be recognized as one of the key enabling technologies for standalone MEMS/Sensor devices which are essential for Internet of things (IoT) solution. A detailed explanation will be given on the sputtering process required for the manufacturing of these batteries. ULVAC has developed reliable hardware and processes for the mass production for solid-state Li batteries.

12:30 **Session Break**

12:40 **Networking Luncheon (All Are Welcome)** *Sponsored By* EVE ENERGY VERY ENDURE

1:40 **Networking Refreshment Break**

Advances with Li-Ions

2:10 **Chairperson's Remarks**

Wenjuan Liu Mattis, Ph.D., Vice President, Research & Development, Microvast, Inc.

2:15 **Advanced Next-Generation Lithium Battery and Beyond**

Wenjuan Liu Mattis, Ph.D., Vice President, Research & Development, Microvast, Inc.

Conventional Li-ion batteries have made progress for HEV applications. However, durability with the PHEV duty cycle and the technology's ultimate cost and safety remain challenges. To achieve a very high all-electric drive range, a new battery system with advanced high-capacity cathode materials and stabilized high-capacity anode is needed. We disclose strategies to significantly increase the energy density of lithium batteries through developing high-energy cathode material coupled with high-voltage electrolyte.

2:45 **Highlights on the Latest Battery Technology Achievements & Challenges**

Sébastien Patoux, Ph.D., Battery Division Manager, CEA – LITEN Institute

We cover Li-ion and post-Li-ion battery technologies for automotive, consumer electronic and stationary applications. We discuss how to push the limits of Li-ion batteries and beyond to have more energy or power, and higher safety. In particular, we present our latest results on Li/sulfur systems, silicon anodes, solid electrolyte and hybrid supercapacitors with a view of the whole value chain, from materials to system.

3:15 **Advances in the Performance of Lac Knife Natural Flake and Expanded Graphite in Electrochemical Power Sources** *Sponsored By* FOCUS GRAPHITE

Joseph E. Doninger, Ph.D., Director, Manufacturing and Technology, Focus Graphite Inc.

Gary Economo, President and CEO, Focus Graphite Inc.

This presentation introduces the development of a super fine, d50 = 10 to15 um, grade of carbon coated spherical flake graphite and shows that the excellent long term cycling performance achieved with the Lac Knife graphite has been extended to 550 cycles. Additional conductivity enhancement data is also presented on the performance of Lac Knife flake and expanded graphite in battery matrices.

3:30 **Advanced Silicon-Based Lib Anode Obtained by Means of Plasma Arc Accelerator in PVD Process** *Sponsored By* GRESEM Innovation

Vyacheslav Chetveryk, Team Member, Research & Development, Gresem Innovation LLC

Environmental-friendly "one-stop" active layer formation process utilizing commonly used gases and micro-size powders resulting in 2.00g/cm3 ready-made LIB anode able to reversibly store up-to 1500 mAh/g. Low porosity reduces electrolyte amount and the production method eliminates binder, solvent and drying processes. Technology is easily integrated (drop-in) into on-market PVD equipment.

3:45 **Grand Opening Refreshment Break in the Exhibit Hall with Poster Viewing**

4:30 **Advances in Lithium Metal Anode-Based Rechargeable Batteries Utilizing Solid-State Electrolytes**

Asmae Mokrini, Ph.D., Senior Research Officer, Automotive and Surface Transportation, National Research Council of Canada

The presentation covers recent developments at the National Research Council on battery technologies based on lithium metal anodes, namely lithium-air and lithium metal polymer battery technologies. Scientific and technological challenges will be highlighted and solutions developed will be presented, including dendrite-prohibiting polymer-based electrolyte development, 3D cathode/solid electrolyte interface engineering, and multi-electrode stack design.

5:00 **Investigation of High-Capacity Ni-Based Layered Oxide Cathodes for Li-Ion Batteries**

Wei Tong, Ph.D., Scientist/Principal Investigator, Lawrence Berkeley National Laboratory

We are interested in developing layered oxide cathodes utilizing Ni^{2+}/Ni^{4+} redox couple as it provides two-electron exchange per transition metal. Our research has been initially directed towards synthesis of high-capacity Ni-based layered oxide cathodes for Li-ion batteries. I present the initial results on synthesis and evaluation of the representative Ni-based layered oxides as well as fundamental studies on understanding their degradation mechanism.

5:30 **Transition to Breakout Discussions**

5:35 **Interactive Breakout Discussion Groups (See website for details.)**

6:35 **Welcome Reception in the Exhibit Hall with Poster Viewing (*Sponsored by* Shanghai Energy)**

7:30 **Close of Day**

WEDNESDAY, MARCH 22

8:00 am **Registration and Morning Coffee**

Enhancing Performance through Testing and Diagnostics

8:20 **Chairperson's Remarks**

Daniel P. Abraham, Ph.D., Materials Scientist, Chemical Sciences and Engineering Division, Argonne National Laboratory

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Next-Generation Battery Research

8:25 Novel Advanced Diagnostics at BatteryX

Jigang Zhou, Ph.D., Staff Scientist, Innovation Division, Canadian Light Source, Inc.; Adjunct Professor, Materials Engineering Department, Western University

BatteryX uses non-destructive characterizations to monitor complex structural and chemical changes that occur in the battery. This leads to deeper practical understanding of batteries' synthesis, surface engineering, device design, and failure mechanisms. We review the platform and newest research at BatteryX such as nanoscale chemical and electronic imaging of real electrode to integrate the fine understanding of interphase structure with charge transportation at interphase.

8:55 Battery Performance Examination through Collective Battery Parameter Test Analysis

Dong Woon Kim, MSc, Engineer, McScience Inc.

Battery performance can be measured by various parameter test experiments. As a cell ages, the test results show changes in the cell parameters. Therefore, a collection of battery parameter data can be used as a reference to measure the battery performance of a given cell. A methodology of establishing such a data collection is suggested, featuring an automatic test measurement device, a metadata format and collective data analysis.

9:25 Coffee Break in the Exhibit Hall with Poster Viewing

10:10 Lithium- and Sodium-Ion Battery Metrology at the Relevant Length Scales Using Advanced Three-Dimensional Transmission Electron Microscopy

Huolin Xin, Ph.D., Associate Scientist, Center for Functional Nanomaterials, Brookhaven National Laboratory

Tracking materials' motion and change from micrometer to the atomic length scales in all three dimensions (3D) lies at the heart of understanding the degradation mechanism(s) of lithium- and sodium-ion battery electrodes. In this talk, I highlight the latest development of 3D imaging in the TEM and its applications in elucidating the mechanism of capacity fading in battery electrodes, including layer-layer compounds and lithium-rich materials.

10:40 FEATURED PRESENTATION: Revealing Aging Mechanisms in Lithium-Ion Cells

Daniel P. Abraham, Ph.D., Materials Scientist, Chemical Sciences and Engineering Division, Argonne National Laboratory

Research on lithium-ion batteries for vehicular applications is being conducted at Argonne as part of the U.S. DOE's Advanced Battery Research (ABR) program. This presentation is an overview of various diagnostic studies conducted to determine aging mechanisms. Data from various experimental studies will be linked together to identify various phenomena responsible for cell performance loss. Identifying these phenomena sources is the first step towards designing long-life lithium-ion cells.

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

Plenary Keynote Program

12:40 pm Opening Remarks

12:45 Battery Innovator Award

12:55 Gigafactory Material Sourcing and Cell Production

Kurt Kelty, Senior Director, Cell Supply Chain & Business Development, Tesla Motors

This presentation will examine the status on material sourcing and sustainable material sourcing for the Gigafactory. In addition, the production of cells for energy products manufactured at the Gigafactory including the Powerwall and Powerpack will be discussed.

1:25 Surprising Chemistry in Li-Ion Cells

Jeff Dahn, Ph.D., FRSC, Professor of Physics and Atmospheric Science, NSERC/Tesla Canada Industrial Research Chair, and Canada Research Chair, Dalhousie University

It is important to increase the operating voltage of NMC Li-ion cells to obtain higher energy density. However, the electrolyte reacts with the positive electrode at high voltage. Using simple experiments involving only pouch bags, we show that the products of these reactions are extremely harmful to the positive electrode. This talk demonstrates how these harmful reactions at the positive electrode can be virtually stopped, leading to superb NMC Li-ion cells that can operate at high potential.

1:55 Advances within the BYD EDV Program and Its Technology

Xi Shen, Ph.D., Senior Director and General Manager, BYD EDV Batteries, China

WenFeng Jiang, Ph.D., R&D General Manager, BYD EDV Batteries, China

The high demand EDV for transportation worldwide has created significant market opportunities for BYD. Since the earlier F3DM and E6, BYD has broadly expanded its EDV business and technology to various fields including public transportation (e6 and E-bus), private transportation (Qin, Tang, etc.) and special transportation (forklift, city logistics vehicle, city cleaning vehicle, etc.) This talk shares the progress of the EDV program.

2:25 Charging Forward: Explosive Global Growth in the Battery Industry – Opportunities and Challenges Ahead

Christina Lampe-Onnerud, Ph.D., CEO, Founder, Chairman, Cadenza Innovation, LLC; Founder, Boston Power

This talk will highlight insights on the emerging global ecosystem that is rapidly developing complex systems and opening doors to innovators who are teaming up with established battery and non–battery players. The presentation will inspire the audience to stay true to data and yet push the design envelope for high performance, low cost, safe energy storage solutions.

2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

3:40 End of Conference

MARCH 22 - 23 | R&D / MANUFACTURING STREAM

Lithium-Ion Development & Commercialization

Delivering Higher Performance at Lower Cost

WEDNESDAY, MARCH 22

11:10 am Conference Registration Open

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

Plenary Keynote Program

12:40 pm Opening Remarks

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2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

R&D: Advancing Li-Ion Chemistries

3:40 Organizer's Opening Remarks

Mary Ann Brown, Executive Director, Conferences, Cambridge EnerTech

3:45 Chairperson's Remarks

Boryann Liaw, Ph.D., Department Manager, Energy Storage and Advanced Vehicles, Clean Energy & Transportation Division, Idaho National Laboratory

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3:50 KEYNOTE PRESENTATION: Storage at the Threshold: Li-Ion Batteries and Beyond

George Crabtree, Ph.D., Director, Joint Center for Energy Storage Research (JCESR), Argonne National Laboratory and University of Illinois at Chicago

High-energy, low-cost lithium-ion batteries have created a revolution in personal electronics. We are at the threshold of similar transformations in transportation to electric cars and in the electricity grid to renewable generation, smart grids and distributed energy resources. These transformations require new levels of energy storage performance and cost beyond the reach of Li-ion batteries. Next-generation beyond Li-ion batteries and their potential to meet these performance and cost thresholds will be analyzed.

4:20 Flexible Protected Li Metal Electrode for Next-Generation Transportation Batteries

Steven J. Visco, Ph.D., CEO and CTO, PolyPlus Battery Company

Efforts to improve Li cycling by moving to solid-state structures based on polycrystalline ceramics have had limited success. We have concluded that in thin-film batteries, the lithium electrode is bonded to a glass surface, leading to a uniform current distribution. PolyPlus is developing thin, flexible protected Li metal electrodes based on highly scalable conductive glass solid electrolytes. This should lead to rechargeable Li metal batteries with energy densities of over 1000 Wh/l and 400 Wh/kg.

Lithium-Ion Development & Commercialization

4:50 Controlling the Surface Chemistry of Cathode Materials for Manufacturing High-Energy Rechargeable Batteries
Feng Lin, Ph.D., Assistant Professor, Department of Chemistry, Virginia Tech
Chemical evolution and structural transformations at the surface of an electrode material influence greatly the key performance metrics of lithium batteries, including energy density, power capability, safety and cycle life. This presentation discusses how we bridge the design principles of surface chemistry in electrode materials with advanced characterization tools, in pursuit of safer and durable lithium batteries.

5:20 High Performance Binders for NMP-Free Cathode Manufacturing of Lithium Ion Batteries *Sponsored By* PPG
Stuart Hellring, Ph.D., Senior Scientist, Research & Development, Automotive Coatings, PPG
PPG has developed new binders for cathode coatings that are formulated without NMP solvent. PPG cathode slurry performance advantages over conventional binders include short mixing times and high formulation solids. PPG binders demonstrate battery performance that is equal or better than cathodes prepared with conventional PVDF binders.

5:35 Networking Reception in Exhibit Hall with Poster Viewing

6:30 Close of Day

THURSDAY, MARCH 23

7:45 am Registration Open

7:45 Interactive Breakout Discussion Groups with Continental Breakfast (See website for details.)

8:45 Session Break

R&D: Improving Materials

9:00 Chairperson's Remarks
George Crabtree, Ph.D., Director, Joint Center for Energy Storage Research (JCESR), Argonne National Laboratory and University of Illinois at Chicago

9:05 Reviving of Lithium Metal Anode through Materials Design
Dingchang Lin, Yi Cui Laboratory, Materials Science and Engineering, Stanford University

9:35 High-Rate Lithium-Ion Battery Development
Wenquan Lu, Ph.D., Principal Chemical Engineer, Chemical Sciences and Engineering, Argonne National Laboratory
The state-of-art carbon black was developed to improve the electrochemical performance of lithium-ion batteries. The electronic conductivity of electrode was systematically investigated. The correlation between the cell performance and electrode composition was determined in this study. This work will guide the cell manufacturers to tailor their products to meet the customer's requirements.

10:05 Graphite Blends that Increase Capacity, Electrode Density, and Power
Edward R. Buiel, Ph.D., President and CEO, Coulometrics, LLC
High-quality blended synthetic/natural graphite has been developed using a new environmentally friendly process that is suitable for production in the U.S. This graphite material has been coated, assembled in 18650 and tested using HPC, and compared with Japanese commercial graphite materials. Blends that increase capacity, electrode density, and power will be discussed.

10:35 Coffee Break in the Exhibit Hall with Poster Viewing

11:20 A123's Advanced Material Development for Vehicle Electrification: Low and High Voltage Application Approaches
Derek C. Johnson, Ph.D., Vice President, Global R&D, A123 Systems, LLC
To produce safe, high-energy density cells, A123 is implementing the same crystal level doping and surface coating approach that has been effective for low-voltage material development. We discuss the high power material development that has resulted in LiSBs with cold crank capabilities that surpass lead-acid batteries and high-energy advancements at the material and cell level to achieve energy densities approaching 300 Wh/kg and 600 Wh/L for EV applications.

11:50 Accelerating Development of Advanced Cathode Materials for Lithium-Ion Batteries
Dee Strand, Ph.D., CSO, Wildcat Discovery Technologies
Over the last decade, many governments have implemented more stringent regulations on vehicle fuel economy and CO2 emissions. For example, European targets for new passenger cars reduce emissions from 2015 levels of 123g CO2/km to 95g CO2/km by 2021. This presentation focuses on the multiple approaches necessary to improve and develop advanced cathode materials to meet the required performance targets. The key learnings from this presentation focus on the importance of multivariate solutions that improve performance of high-energy cathodes.

12:20 pm Advanced Instrumentation to Study Electrode and Electrochemistry Processes at Different Scales and Frequencies *Sponsored By* KEYSIGHT TECHNOLOGIES
Manuel Kasper, Research Scientist, Keysight Labs, Keysight Technologies
A Source/Measure Unit (SMU) is used for electrochemical 3-electrode measurements including cyclic-voltammetry (C-V) and chrono-amperometry, and applied to various redox systems including Li-ion cells. In comparison to the conventional potentiostat-based setup, the SMU has very sensitive current and voltage measurements. Furthermore, bulk redox measurements are compared to nanoscale electrode AFM C-V imaging.

12:35 Sponsored Presentation *(Opportunity Available)*

12:50 Session Break

1:00 Networking Luncheon (All Are Welcome) *Sponsored By* HIGHPOWER

2:00 Dessert Break in the Exhibit Hall with Poster Viewing

Lithium-Ion Development & Commercialization

R&D: Prototypes, Manufacturing & Scale-Up

2:30 Chairperson's Remarks
David L. Wood, III, Ph.D., Roll-to-Roll Manufacturing Team Lead & Fuel Cell Technologies Program Manager, Energy & Transportation Science Division, Oak Ridge National Laboratory

2:35 Battery Materials Scale-Up and Manufacturing Research
Gregory K. Krumdick, Principal Systems Engineer, Energy Systems Division, Argonne National Laboratory

3:05 Solvent-Free Manufacturing of Electrodes for Lithium-Ion Batteries
Heng Pan, Ph.D., Assistant Professor, Department of Mechanical & Aerospace Engineering, Missouri University of Science and Technology
Li-ion batteries have dominated the power supply market for electronics. However, the high cost has hindered wider adoption for large devices. The conventional slurry-based electrode manufacturing is a time-consuming, energy-intensive and complex process, which increases the manufacturing cost. To reduce manufacturing cost, a solvent-free Li-ion battery manufacturing process has been developed. This talk presents the process characteristics, device performance and scale-up of the solvent-free manufacturing process.

3:35 High-Performance Li-Ion Capacitor Laminate Cells
Ben Cao, Ph.D., Director & Principal Investigator, R&D, General Capacitor LLC
High-performance Li-ion capacitor (LIC) laminate cells have been fabricated with activated carbon positive electrodes (PEs) and hard carbon/lithium stripes negative electrodes (NEs). Their specific energy and energy density are 14 Wh kg-1 and 28 Wh L-1 with maximum specific power of 6 kW kg-1. The DC life of such LIC cells has passed 2000 h at maximum operation voltage 3.8 V and 65 °C. Such LIC can remain 89% of the original discharge capacitance after 100,000 cycles under 50C rate charge-discharge.

4:05 Networking Refreshment Break

R&D: Cost Reduction & Energy Density Improvements for BEVs

4:15 Manufacturing R&D for Low-Cost, High-Energy Density Lithium-Ion Batteries for Transportation Applications
David L. Wood, III, Ph.D., Roll-to-Roll Manufacturing Team Lead & Fuel Cell Technologies Program Manager, Energy & Transportation Science Division, Oak Ridge National Laboratory
Li-ion battery pack costs have dropped from ~$500-600/kWh to $275-325/kWh due to economies of scale, improvements in electrode and cell quality control, and more efficient production methods. However, more development on electrode processing cost reduction, coating deposition quality control, and cell assembly methods must occur to meet DOE ultimate pack cost of $125/kWh for battery electric vehicles (BEVs). Cell energy densities must still be increased 150-180 Wh/kg to 350 Wh/kg for sufficient BEV driving range. We cover ORNL's major research activities contributing to cost reduction and energy density improvements in Li-ion cells.

4:45 KEYNOTE PRESENTATION: How to Significantly Increase Energy Density of Lithium-Ion Batteries without Changing Chemistry
Rachid Yazami, Ph.D., Professor and Principal Scientist, Energy Research Institute (ERIAN), Nanyang Technological University
Efforts to increase energy density of LIBs have been for the most part focused on developing anode and cathode materials with higher lithium storage capabilities and, for the cathode, higher operating voltages. This approach, however, may alter cycle life and safety. Here we disclose a new approach consisting on optimized utilization of full storage capability of anode and cathode. In fact, using thermodynamics measurements and analytical methods we found that in most commercial LIBs anode and cathode are used within a limited lithium composition range 20 to 40% below what is achieved in half cells. A strategy to enhance electrode utilization rate and, therefore, energy density by over 20% will be presented and discussed.

5:45 Close of Conference

MARCH 21 - 22 | MANUFACTURING STREAM

High Performance Battery Manufacturing

Global Production of Safe, Efficient, Higher Energy Density Batteries

MONDAY, MARCH 20

7:00 am – 4:00 pm Tutorial* Registration Open

7:00 – 8:00 am Morning Coffee

8:00 – 4:00 Pre-Conference Tutorials*

12:30 – 1:30 pm Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

1:30 – 2:00 Networking Refreshment Break

*** See page 4 for Tutorial details. Separate registration required for Tutorials.**

TUESDAY, MARCH 21

7:30 am Registration and Morning Coffee

Innovation and Design for Manufacturing

8:30 Organizer's Opening Remarks
Craig Wohlers, Executive Director, Conferences, Cambridge EnerTech

8:35 Chairperson's Remarks
Franz Kruger, Ph.D., Head of Business Unit, Treofan Group

8:40 KEYNOTE PRESENTATION: The Kinetic Characteristics of the EDV Cell and Their Applications in EDV Industry
John Zhang, Ph.D., Senior Technology Executive Officer, Asahi Kensai Group, Japan
Besides battery safety and battery coat issues of EDV industry, the kinetic properties of the EDV cell (battery) impose another critical and important impact on EDV market and EDV performance. We will address the kinetic properties of the EDV battery, such as DCR of the cell and components (instead of the classic measured static impedance), to address the EDV cell performance and rationalizing cell design of EDV to ensure lasting large current charge and discharge and to reduce their impact on EDV cell cycle life.

9:10 The Commercialization of Water-Based LiFePO4 Cathode in Li-Ion Batteries for xEV and ESS Applications
Zhou Jiang, Ph.D., Vice President, Lishen Research Institute, Tianjin Lishen Battery Joint Stock Co., Ltd., China
This talk will present the work of Tianjin Lishen Battery Joint-Stock Co. Ltd on water-based LiFePO4 cathode in Li-ion batteries. Cylindrical, prismatic and pouch batteries using water-based LiFePO4 cathode are successfully developed. Batteries employing water-based LiFePO4 cathode exhibit similar performance to those using NMP-based LiFePO4 cathode. The newly developed batteries will be widely used in xEV and ESS applications.

9:40 Chinese EV Market & Cathode Materials Used for Automotive LIBs
Yuan Gao, Ph.D., President and CEO, PULEAD, China
The Chinese EV market is experiencing an unprecedented growth, and it is having a great impact on the whole supply chain including all components beyond China. The growth and its implications to the cathode chemistries as well as the raw materials used upstream will be discussed.

10:10 Networking Coffee Break

10:45 Research Progress of Advanced Materials for Lithium-Ion Batteries
Peter Cheng, Ph.D., Chief Scientist, HighPower International, China
Synergistic effect of electrolyte additives was studied for the lithium ion batteries with high voltage cathode materials. Design and development of advanced batteries with high energy density. Design and development of solid sate batteries. POM materials with improved electrochemical performance as the cathode materials of lithium ion batteries.

11:15 The Grand Challenge of Advanced Batteries
Kev Adjemian, Ph.D., Division Director, Clean Energy & Transportation, Idaho National Laboratory
The Energy Storage and Advanced Vehicles department at the Idaho National Laboratory is working with other stakeholders to develop capabilities to facilitate the development of advanced battery systems. In this presentation, the current barriers and understandings of the shortcomings in the battery performance will be discussed. The issues with durability, reliability and safety will be depicted to help understanding the grand challenge and to develop the strategy to address and overcome this grand challenge faced by the battery research community.

11:45 Towards the Commercialization of High Energy Density Na-Ion Batteries
Jerry Barker, Ph.D., Founder and CTO, Faradion Limited
Sodium-ion (Na-ion) batteries represent an attractive alternative to their lithium-ion counterparts, and are expected to offer some significant commercial advantages such as lower material costs and improved safety characteristics. To demonstrate the commercial viability of Na-ion batteries, Faradion has scaled-up this cell chemistry to the 10 Ah (32 Wh) prototype cell level using traditional Li-ion manufacturing methods. Performance, cost and safety characteristics of the Faradion Na-ion cells will be described during the presentation.

High Performance Battery Manufacturing

12:15 pm The Study of Thermal Management System with Intelligent Temperature Control for Power Battery Pack

Sponsored By EVE ENERGY VERY ENDURE

Jimson Jiang, Senior Engineer, Research & Development, EVE Energy Co., Ltd.
Helen Lin, Director, Sales, EVE Energy Co., Ltd.

The thermal management system, which adopts advanced thermal management scheme and intelligent control strategy, can guarantee that the pack works at an optimum and uniform temperature during the charging and discharging processes at different climate conditions.

12:30 Session Break

12:40 Networking Luncheon (All Are Welcome)

Sponsored By EVE ENERGY VERY ENDURE

1:40 Networking Refreshment Break

Advances in Cell Manufacturing

2:10 Chairperson's Remarks

Christophe Pillot, Ph.D., Battery Survey Manager, Avicenne Energy, France

2:15 High Volume Li-Ion Manufacturing

Henry Mao, Ph.D., CEO, Youlion Battery Ltd., China

Reducing battery costs to levels affordable by mass markets is critical to the success of electric vehicles. Over the past decade, China has become the world's leader in lithium-ion manufacturing, creating huge cost-efficiencies across a vertically integrated, domestically-sourced supply chain. This talk will describe a new lower-cost cell technology and the advancements in production at the Youlion Battery factory.

2:45 Pre-Lithiumation in Cell Production, Realistic or Impractical?

Hang Shi, Ph.D., President, Hslion Consulting; formerly CTO, Tianjin Lishen Battery, Ltd., China

The benefits of a lithium ion cell made by pre-lithiumated anode are multifold. The two practical pre-lithiumation methods by lithium powder and foil are discussed in this presentation. The industrial production of lithium-ion cells with pre-lithiumated anode is recently made possible with innovative equipment.

3:15 Lowering Operational Costs during Cell Forming

Sponsored By KEYSIGHT TECHNOLOGIES

Greg Schuster, Business Development Manager, Automotive and Energy Solutions (AES), Keysight Technologies

To keep margins up, battery cells must be manufactured inexpensively. Unlike equipment costs that are paid once, operational costs scale with the number of cells formed. This presentation will cover how to lower operational costs through efficient use of electricity and lower maintenance costs while providing high quality cell measurements.

3:30 Evaluation of Factory Infrastructure for Advanced Battery Manufacturing

Sponsored By M+W GROUP

Ankush Halbe, M.S., Technology Director, Renewable Energy, M+W Group

The battery industry is highly cost competitive and requires that the building and facilities construction for cell manufacturing be rapid, lean, and energy efficient. A building and interior design concept is presented for a battery cell factory that delivers cell production materials into the facility, and ships out finished product with minimal site and utility impact. The design of the facility systems for air and chemical handling is driven primarily by the process, material, and personnel requirements inside the battery facility. Some battery facilities require advanced Dry rooms with <1% RH to maintain cell performance and safety specifications. Advanced Dry room technology development also considers several other critical manufacturing parameters such as temperature, chemistry, automation, machine loads, energy consumption, and others.

3:45 Grand Opening Refreshment Break in the Exhibit Hall with Poster Viewing

4:30 Li-Ion Technology for Space, Defense and Industrial Applications

Thomas Greszler, Chemistry Division Manager, SAFT

Recent progress on LTO, in regards to engine starter and low-earth-orbit satellite batteries, will be presented especially in regards to high temperature operation which has been enabled by understanding and mitigating gas generation. In addition, performance and life data will be presented for Mn-phosphate based cells. Finally, challenges and progress toward operation of Li-ion cells at >100°C will be discussed.

5:00 Analysis of Li-Ion Battery Joining Technologies

Wayne Cai, Ph.D., Staff Researcher, General Motors

This talk provides a comprehensive review and analysis of joining technologies for automotive lithium-ion battery manufacturing. It compares the advantages and disadvantages of the different joining technologies as related to battery manufacturing, including ultrasonic welding, resistance welding, laser beam welding, wire-bonding, and mechanical joining. Joining processes for electrode-to-tab, tab-to-tab, tab-to-busbar, and module-to-module assembly are discussed with respect to cell types and pack configuration.

5:30 Transition to Breakout Discussions

5:35 Interactive Breakout Discussion Groups (See website for details.)

6:35 Welcome Reception in the Exhibit Hall with Poster Viewing (*Sponsored by* Shanghai Energy)

7:30 Close of Day

High Performance Battery Manufacturing

WEDNESDAY, MARCH 22

8:00 am Registration and Morning Coffee

Advances in Cell Manufacturing (Cont.)

8:20 Chairperson's Remarks
Henry Mao, Ph.D., CEO, Youlion Battery Ltd., China

8:25 What Are the Economies of Scale to Be Expected When Growing 10X?
Kurt Vandeputte, Vice President, Rechargeable Battery Materials Business Unit, Umicore
We see the Li-ion battery industry going through unseen change in terms of volume expectations and price target setting. Combining these two aspects is extremely challenging in an environment where supply can never be interrupted. In this presentation we take a closer look at how these challenges can be met and what the practical benefits would be for the industry.

8:55 Cell Finishing - The Underestimated Cost and Performance Factor
Raf Goossens, Ph.D., CEO, Global Corporate Management, PEC
The cell finishing process is the most costly and critical process during cell manufacturing. The forming of a homogeneous Solid Electrolyte Interface (SEI) is key for the future cell performance and cycle life but often underestimated. The upcoming new silicone based electrodes make the process even more challenging and critical. Besides these technical challenges, we should never forget that cell finishing includes the most risk-sensitive processes, and many disastrous accidents with severe fires and plants burning down have happened already.

9:25 Coffee Break in the Exhibit Hall with Poster Viewing

Supply Chain Sustainability

10:10 Lithium-Ion Battery Raw Material Supply and Demand 2015 – 2025
Christophe Pillot, Ph.D., Battery Survey Manager, Avicenne Energy, France
This presentation includes cathode, anode, electrolyte and separator demand. It will examine the major component suppliers and include a discussion on price evolution and major technical trends.

10:40 Sustainable Supply Chain for Sustainable Manufacturing
Shailesh Upreti, Ph.D., President, C4v; Center of Excellence, SUNY Binghamton
Green products demand an overall net greener footprint when it comes to manufacturing and commercializing Li-ion storage technologies. There are many elements in raw material supply chain that make Li-ion manufacturing a bit concerning from toxic or emission point of view and my talk will highlight some of such topics and the work I have been doing in bringing innovation from other areas to Li-ion supply chain.

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

Plenary Keynote Program

12:40 pm Opening Remarks

12:45 Battery Innovator Award

12:55 Gigafactory Material Sourcing and Cell Production

Kurt Kelty, Senior Director, Cell Supply Chain & Business Development, Tesla Motors
This presentation will examine the status on material sourcing and sustainable material sourcing for the Gigafactory. In addition, the production of cells for energy products manufactured at the Gigafactory including the Powerwall and Powerpack will be discussed.

1:25 Surprising Chemistry in Li-Ion Cells

Jeff Dahn, Ph.D., FRSC, Professor of Physics and Atmospheric Science, NSERC/Tesla Canada Industrial Research Chair, and Canada Research Chair, Dalhousie University
It is important to increase the operating voltage of NMC Li-ion cells to obtain higher energy density. However, the electrolyte reacts with the positive electrode at high voltage. Using simple experiments involving only pouch bags, we show that the products of these reactions are extremely harmful to the positive electrode. This talk demonstrates how these harmful reactions at the positive electrode can be virtually stopped, leading to superb NMC Li-ion cells that can operate at high potential.

1:55 Advances within the BYD EDV Program and Its Technology


Xi Shen, Ph.D., Senior Director and General Manager, BYD EDV Batteries, China
WenFeng Jiang, Ph.D., R&D General Manager, BYD EDV Batteries, China
The high demand EDV for transportation worldwide has created significant market opportunities for BYD. Since the earlier F3DM and E6, BYD has broadly expanded its EDV business and technology to various fields including public transportation (e6 and E-bus), private transportation (Qin, Tang, etc.) and special transportation (forklift, city logistics vehicle, city cleaning vehicle, etc.) This talk shares the progress of the EDV program.

2:25 Charging Forward: Explosive Global Growth in the Battery Industry – Opportunities and Challenges Ahead

Christina Lampe-Onnerud, Ph.D., CEO, Founder, Chairman, Cadenza Innovation, LLC; Founder, Boston Power
This talk will highlight insights on the emerging global ecosystem that is rapidly developing complex systems and opening doors to innovators who are teaming up with established battery and non–battery players. The presentation will inspire the audience to stay true to data and yet push the design envelope for high performance, low cost, safe energy storage solutions.

2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

3:40 End of Conference

MARCH 21 - 22 | APPLICATIONS STREAM

Advances in Automotive Power Applications

Implementing & Optimizing the Performance of Vehicle Battery Packs

MONDAY, MARCH 20

7:00 am – 4:00 pm Tutorial* Registration Open

7:00 – 8:00 am Morning Coffee

8:00 – 4:00 Pre-Conference Tutorials*

12:30 – 1:30 pm Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

1:30 – 2:00 Networking Refreshment Break

*** See page 4 for Tutorial details. Separate registration required for Tutorials.**

TUESDAY, MARCH 21

7:30 am Registration and Morning Coffee

Battery Safety Testing & Regulation

8:30 Organizer's Opening Remarks
Craig Wohlers, Executive Director, Conferences, Cambridge EnerTech

8:35 Chairperson's Remarks
Ted J. Miller, Manager, Energy Storage and Materials Strategy and Research, Ford Motor Company

8:40 KEYNOTE PRESENTATION: Progress in Battery Safety Performance Simulation
Ted Miller, Manager, Energy Storage and Materials Strategy and Research, Ford Motor Company
Advanced automotive batteries are the critical enabling technology for vehicle electrification. Ford has undertaken development of a battery safety simulation tool. This is a first-of-its-kind multi-physics (combined mechanical, electrical, electrochemical, and thermal) CAE tool to predict battery response to a range of abuse conditions including crush due to crash and/or battery regulatory tests, short circuit, overcharge, and thermal ramp. An update on development progress and results from the alpha version of the prototype tool will be presented.

9:10 U.S. Department of Energy Electric Vehicle Battery Research Pathways and Key Results
Brian Cunningham, Engineer, Vehicle Technologies Office, Energy Storage R&D, U.S. Department of Energy
The U.S. Department of Energy set key technical targets necessary to enable Electric Vehicles (EV) to be as affordable as gasoline vehicles by 2022. A focus of this effort is the development of more cost-effective, longer lasting, and more abuse-tolerant EV batteries. VTO's battery R&D effort includes multiple activities, ranging from battery materials research to battery cell and pack development and testing. This paper will highlight the current battery R&D pathways supported by VTO and key technical results from 2016.

9:40 International Compliance for Li-Ion Batteries
Cynthia Millsaps, President and CEO, Quality, Energy Assurance LLC
International compliance for Li-ion batteries is not as straight forward as some other product categories. We will discuss transportation, mandatory and voluntary testing and certification requirements. It will include Marks of conformity that are needed as well as look at common issues that arise during the process.

10:10 Networking Coffee Break

OEM Application-Driven Development

10:45 Toyota's Vision for Vehicle Electrification
Michael Lord, Executive Engineer, Product Regulatory Affairs, Toyota Motors North America
The presentation will introduce the audience to Toyota's 2050 Environmental Challenge which includes goals for both zero vehicle emissions and zero life cycle emissions. For full electric drive, Toyota is currently focused on the launch of the Mirai Fuel Cell Vehicle and believes that fuel cell vehicles have the greatest potential for use as general purpose household cars and large vehicles.

11:15 Experimental and Theoretical Developments Necessary for the Use of Silicon Electrodes in Traction Battery Systems
Mark Verbrugge, Ph.D., Director, Chemical and Materials Systems Laboratory, General Motors
We have developed a method to operate lithium-silicon (Li-Si) thick-film electrodes in a manner consistent with traction applications. Key to the operating strategy is the voltage control of the electrode. A modified hysteresis model, based in part on our earlier approach to treat NiMH (nickel metal hydride) cells, is shown to represent well the constant-current cycling data, and open questions associated with needed improvements in modeling Li-Si hysteresis and related low-current phenomena are highlighted.

Advances in Automotive Power Applications

11:45 Advanced Lithium-Ion Battery Separators with Functional Coatings for High Energy Density Automotive Application
Kelvin Wu, Director, Marketing, SEMCORP
Lithium-ion batteries for EDVs demand both high performance and high safety standards. This presentation will discuss tailor-making advanced separators with precise control over pore size, structure, and dimensional strength. It will examine the advanced coating technologies SEMCORP developed to meet the high safety standards for high-energy density chemistry, as well as their impact on cell performance. It will provide an overview of SEMCORP's world-class separator giga-factories, which has 1.3B m2 in total film capacity.

12:15 pm Sponsored Presentation *(Opportunity Available)*

12:30 Session Break

12:40 Networking Luncheon (All Are Welcome) *Sponsored By* EVE ENERGY VERY ENDURE

1:40 Networking Refreshment Break

OEM Application-Driven Development (Cont.)

2:10 Chairperson's Remarks
Mark Verbrugge, Ph.D., Director, Chemical and Materials Systems Laboratory, General Motors

2:15 Advancing Battery Technology for Mercedes-Benz Applications
Tobias Glossman, Senior Engineer, Mercedes-Benz Research and Development North America
Advanced battery technology is a key component for electric transportation solutions today. The market's demand for higher energy content, faster charging, and other parameters is high and solutions are not easy to find. This presentation points out some areas that hold opportunities for improvement and discusses some approaches to the challenge. Battery chemistry, cell system, and thermal management are some of the areas that will be considered.

2:45 Research and Development towards Future Automotive Li-Ion Cells
Odysseas Paschos, Ph.D., Research Battery Technology, BMW, Germany
The BMW Group has shown a strong commitment to sustainable mobility, which has also been reflected to various research topics that aim on identifying key potential technologies that can be used for future lithium-ion batteries. Candidate technologies have been proposed during the last years with several of them having a potential to improve the current state-of-the-art. This presentation will discuss which requirements need to be fulfilled in order to achieve future automotive Li-ion cells with optimized parameters for vehicle applications.

3:15 Ultrafast Charging Silicon-Dominant Anode and Li-ion Cell Technology for EV Applications *Sponsored By* ENEVATE
Benjamin Park, Ph.D., Founder & CTO, Enevate Corporation
Unlike conventional graphite-dominant silicon technologies which typically involve adding silicon-containing additives to graphite, silicon-dominant technologies in Li-ion batteries offer many benefits for electric vehicles including high energy density, ultrafast charge, wide temperature operation, and safety. Data showing upwards of 4C ultrafast charging and low temperature performance will be shown along with an analysis of technology benefits for EV applications. In addition, safety advantages of silicon-dominant cells will be discussed.

3:45 Grand Opening Refreshment Break in the Exhibit Hall with Poster Viewing

4:30 Large Pouch MP NCM EV Cells For EV/PHEV, Bus and Car Applications
Tony Li, Ph.D., Director R&D, Zhuhai Coslight, China
Compared with other types of Li-ion batteries (prismatic, cylindrical), pouch type Li-ion batteries have the advantage of size flexibility (very low cost to customize new dimension), high specific energy density, better safety and good pack space utilization for electrical vehicle applications. This format is the choice of top brands like the Nissan Leaf and Chevrolet Volt. Zhuhai Coslight's mainstream MP NCM EV cell can achieve >3000 cycle life with ~200Wh/kg gravimetric energy density, further increased to 255 Wh/kg by the end of 2017 through new chemistry introduction. A long term R&D strategy is steadily pushing forward and targets 300Wh/kg energy density by 2020.

5:00 Advanced Automotive and Storage Lead Batteries and the New ILA/ALABC Program
Boris Monahov, Ph.D., Program Manager, Advanced Lead-Acid Battery Consortium (ALABC) – a program of the International Lead Association (ILA)
Alistair Davidson, Ph.D., Director, Products and Sustainability, International Lead Association
The new R&D program of ILA/ALABC is focused on basic science studies for revealing new ways of substantial battery enhancement for low emission vehicles and for advanced energy storage systems. All three active materials as well as cell design will be subject of optimization so that lead batteries continue being the power source of choice in traditional and emerging new niches. Advanced lead batteries offer more power and much longer cycle life but continue keeping the lowest cost level and production CO2 footprint, plus the highest recycling rate.

5:30 Transition to Breakout Discussions

5:35 Interactive Breakout Discussion Groups (See website for details.)

6:35 Welcome Reception in the Exhibit Hall with Poster Viewing (*Sponsored by* Shanghai Energy)

7:30 Close of Day

WEDNESDAY, MARCH 22

8:00 am Registration and Morning Coffee

Innovation & Design in Next-Gen Transportation Applications

8:20 Chairperson's Remarks
Steven J. Visco, Ph.D., CEO and CTO, PolyPlus Battery Company

Advances in Automotive Power Applications

8:25 KEYNOTE PRESENTATION: Technology Convergence: Real World Adoption of Vehicle Electrification Strategies
Craig Rigby, Advanced Market & Technology Strategist, Johnson Controls Power Solutions
Over the last 15 years, increasing vehicle efficiency and reducing fuel consumption have been the key drivers behind the development of advanced batteries and other electrification technologies. This talk will discuss the nature of those trends, the influence they have on vehicle electrification and how the convergence of these technologies will help accelerate the adoption of advanced battery technology across a wide range of applications.

8:55 A123's High Performance Battery Systems Development
Patrick Hurley, Ph.D., CTO, A123 Systems, LLC
A123 is well known as a developer and manufacturer of lithium ion cells based on our proprietary lithium iron phosphate cathode material. 2015-16 has been a year of expansive growth in the development and commercialization of cells, packs and systems, leveraging both LFP and higher energy oxide chemistries. This presentation will share A123's expanded product portfolio for current transportation application demands, as well as provide a glimpse at technologies which are under development for the extended range full electric vehicles of tomorrow.

9:25 Coffee Break in the Exhibit Hall with Poster Viewing

10:10 KEYNOTE PANEL DISCUSSION: Global Trends in Vehicle Electrification and Automotive Battery Technologies
This panel will discuss the current global trends in vehicle electrification and the advances in automotive battery technology. This distinguished group will highlight their participation in the various segments from materials, cell and costs points of view.
Moderator: Mohamed Alamgir, Director of Research, LG Chem Power
Panelists to be Announced

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

Plenary Keynote Program

12:40 pm Opening Remarks

12:45 Battery Innovator Award

12:55 Gigafactory Material Sourcing and Cell Production

Kurt Kelty, Senior Director, Cell Supply Chain & Business Development, Tesla Motors
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Christina Lampe-Onnerud, Ph.D., CEO, Founder, Chairman, Cadenza Innovation, LLC; Founder, Boston Power
This talk will highlight insights on the emerging global ecosystem that is rapidly developing complex systems and opening doors to innovators who are teaming up with established battery and non–battery players. The presentation will inspire the audience to stay true to data and yet push the design envelope for high performance, low cost, safe energy storage solutions.

2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

3:40 End of Conference

Emerging Energy Storage Applications

Delivering the Right Charge at the Right Time

WEDNESDAY, MARCH 22

11:10 am Conference Registration Open

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

Plenary Keynote Program

12:40 pm Opening Remarks

12:45 Battery Innovator Award

12:55 Gigafactory Material Sourcing and Cell Production

Kurt Kelty, Senior Director, Cell Supply Chain & Business Development, Tesla Motors

This presentation will examine the status on material sourcing and sustainable material sourcing for the Gigafactory. In addition, the production of cells for energy products manufactured at the Gigafactory including the Powerwall and Powerpack will be discussed.

1:25 Surprising Chemistry in Li-Ion Cells

Jeff Dahn, Ph.D., FRSC, Professor of Physics and Atmospheric Science, NSERC/Tesla Canada Industrial Research Chair, and Canada Research Chair, Dalhousie University

It is important to increase the operating voltage of NMC Li-ion cells to obtain higher energy density. However, the electrolyte reacts with the positive electrode at high voltage. Using simple experiments involving only pouch bags, we show that the products of these reactions are extremely harmful to the positive electrode. This talk demonstrates how these harmful reactions at the positive electrode can be virtually stopped, leading to superb NMC Li-ion cells that can operate at high potential.

1:55 Advances within the BYD EDV Program and Its Technology

Xi Shen, Ph.D., Senior Director and General Manager, BYD EDV Batteries, China

WenFeng Jiang, Ph.D., R&D General Manager, BYD EDV Batteries, China

The high demand EDV for transportation worldwide has created significant market opportunities for BYD. Since the earlier F3DM and E6, BYD has broadly expanded its EDV business and technology to various fields including public transportation (e6 and E-bus), private transportation (Qin, Tang, etc.) and special transportation (forklift, city logistics vehicle, city cleaning vehicle, etc.) This talk shares the progress of the EDV program.

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2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

Stationary Energy Storage: Grid Applications

3:40 Organizer's Opening Remarks

Mary Ann Brown, Executive Director, Conferences, Cambridge EnerTech

3:45 Chairperson's Remarks

Kevin Fok, Senior Project Manager, LG Chem Power, Inc., a subsidiary of LG Chem, Ltd.

3:50 Quality Assurance for PV Battery Power Plants and PV Battery Systems in Commercial Applications and Mini-Grids

Matthias Vetter, Ph.D., Head, Electrical Energy Storage, Fraunhofer Institute for Solar Energy Systems ISE

The integration of battery storage in grid-connected photovoltaic systems or PV diesel mini-grids enables high solar fractions and is often more cost-effective than conventional power supplies relying upon fossil fuels. With this presentation, a wide array of services – necessary for a successful implementation and operation of PV battery systems – will be described. Included are the quality assurance of PV systems, battery system technology and battery storage integration in PV systems.

4:20 Integrated Solar Energy Conversion and Redox Flow Battery Devices

Song Jin, Ph.D., Professor, Chemistry, University of Wisconsin-Madison

Due to the intermittent nature of sunlight, practical solar energy utilization systems demand both efficient solar energy conversion and inexpensive large-scale energy storage. Compared with separated solar conversion and storage devices, combining both functions into a single integrated device represents a more efficient, compact and cost-effective approach to utilize solar energy. We have developed novel integrated solar-charged storage devices that build on silicon solar cells and emerging organic redox flow batteries.

Emerging Energy Storage Applications

4:50 Energy Storage Project Perspectives and Case Studies
Kevin Fok, Senior Project Manager, LG Chem Power, Inc., a subsidiary of LG Chem, Ltd.
During the past several years, energy storage systems have been implemented into the electric grid for key applications. This presentation covers the perspectives and experiences gained during the course of developing, installing, commissioning, and operating energy storage projects. Case studies of recently deployed projects will also be discussed.

5:20 Rationally Designed 1D/2D Core/Shell Nanowires for Flexible Supercapacitors
Nitin Choudhary, Ph.D., Postdoctoral Associate, Yeonwoong (Eric) Jung Research Group, NanoScience Technology Center, University of Central Florida
The present study explores a novel 1D/2D core/shell flexible supercapacitor design enabled by facile oxidation/sulfurization methods. One-body evolution of 1D h-WO3 core and 2D transition metal dichalcogenide (TMD) WS2 shell from a tungsten (W) foil renders high mechanical integrity, seamless atomic interfaces, and fast ion-transport for high-performance electrochemical performance. These flexible supercapacitors exhibit excellent energy density (0.06 Wh/cm3) and unprecedented cycle life (30,000 cycles), outperforming almost all the state-of-the-art technologies such as lithium thin-film batteries, porous graphene, and electrolytic capacitors.

5:35 Networking Reception in Exhibit Hall with Poster Viewing

6:30 Close of Day

THURSDAY, MARCH 23

7:45 am Registration Open

7:45 Interactive Breakout Discussion Groups with Continental Breakfast (See website for details.)

8:45 Session Break

Flow Batteries: Deliver the Right Charge at the Right Time

9:00 Chairperson's Remarks
H. Frank Gibbard, Ph.D., CEO, CTO & Co-Founder, WattJoule Corp.

9:05 FEATURED PRESENTATION: Organic Aqueous Flow Batteries for Massive Electrical Energy Storage
Michael J. Aziz, Ph.D., Gene and Tracy Sykes Professor of Materials and Energy Technologies, John A. Paulson School of Engineering and Applied Sciences, Harvard University
Storing large amounts of electrical energy is increasingly important with growing electricity generation from intermittent renewable sources. Flow batteries show promise because the designer can independently scale the power and energy components of the system by maintaining all electro-active species in fluids, but abundance and cost of these materials limit wide-scale utilization. We have developed an approach using the aqueous redox chemistry of small, inexpensive organic molecules such as quinones. This may enable massive electrical energy storage at greatly reduced cost.

9:35 Next-Generation Liquid Energy Storage Systems
H. Frank Gibbard, Ph.D., CEO, CTO & Co-Founder, WattJoule Corp.
This presentation reviews recent advances in the technology and near-term prospects for commercialization of redox flow batteries. Emphasis is placed on the most promising electrochemical systems; advanced supporting electrolytes for high performance, greater energy density, and lower cost; advanced materials and cell stack designs for high power; and the prospects for long system lifetime, high cycle life, safety and low cost.

10:05 New Membranes for Aqueous Batteries
Michael A. Hickner, Ph.D., Associate Professor, Corning Faculty Fellow, Materials Science and Engineering, Chemical Engineering, Pennsylvania State University
New polymer membranes are needed to advance energy storage and conversion technologies for distributed and grid-scale applications. We have recently demonstrated new ion-conducting polymer membranes that have achieved excellent performance and long-lifetime stability in vanadium redox flow batteries, a leading technology candidate for deployment in renewable power networks and grid-scale energy storage systems with sizes ranging from 10s to 100s of megawatts. Membrane designs for aqueous systems will be discussed.

10:35 Coffee Break in the Exhibit Hall with Poster Viewing

Hybrid Formats for ESS

11:20 Hybrid-Supercapacitors Bridge the Energy Gap between Batteries and Capacitors
Gene Armstrong, MSEE, Director of Applications, Engineering, Paper Battery Company
Advances in asymmetric supercapacitors and Hybrid-Supercapacitors now provide a competitive alternative to EDLC Supercapacitors and battery technology in multiple application spaces. With an energy density exceeding that of lead-acid and 5 times greater than EDLCs, Hybrid-Supercapacitors will eventually challenge traditional battery technology across more applications requiring long life, safety and high reliability. We present a comparative analysis of Hybrid-Supercapacitors, EDLCs and Li-ion batteries and their intersecting applications.

11:50 Hybrid-Energy Storage Systems at Siemens Mobility
Michael Meinert, Ph.D., Senior Expert, Energy Storage Systems & Head, Centre of Expertise Energy Storage Systems, Mobility Division, Technology and Innovation, Siemens AG
Use of Energy Storage Systems containing DLC and traction batteries on trams were developed by the prototyping at the customer site south of Lisbon. Nowadays, the first fleet is being commissioned in Qatar using DLC, lithium-

Emerging Energy Storage Applications

ion battery and charging units to drive the trams without catenary. Further applications on Rolling Stock or buses will use traction batteries and charging units. The presentation gives an overview about technologies used at Siemens Mobility.

12:20 pm Lithium-Ion Battery Modeling, Simulation, and Mobile Power Grid
Khosrow (Nema) Nematollahi, Ph.D., Chairman and CTO, Renewable Energy, Advanced Renewable Power LLC
All Allison transit buses in the Unites States and Europe are installing the lithium-ion battery that I engineered fully by digital modeling and simulation. I used advanced Finite Element Analysis (FEA) for thermal, fluid, stress, shock, vibration, and impact.

12:50 Session Break

1:00 Networking Luncheon (All Are Welcome)

Sponsored By HIGHPOWER 豪鹏国际

2:00 Dessert Break in the Exhibit Hall with Poster Viewing

Alternative Chemistries: Deliver the Right Charge at the Right Time

2:30 Chairperson's Remarks
Eugene S. Smotkin, Ph.D., Department of Chemistry and Chemical Biology, Northeastern University

2:35 Environmental Life Cycle Issues with Perfluorinated Sulfonated Ionomer-Based Fuel Cells
Eugene S. Smotkin, Ph.D., Department of Chemistry and Chemical Biology, Northeastern University

3:05 A High-Power, Long Cycle Life Sodium-Ion Battery Based on Prussian Blue Electrodes
Colin Wessells, Ph.D., CEO, Alveo Energy
Alveo Energy has developed a novel sodium-ion cell chemistry for high-power, long cycle life stationary applications. These cells are based on Prussian blue electrodes and an aqueous-organic cosolvent electrolyte and have achieved tens of thousands of deep discharge cycles without appreciable loss. This presentation focuses on the relationship between fundamental materials properties and the device-level performance of the resulting technology.

3:35 Development of Ni-MH Battery for Electronical Energy Storage Systems and Lifetime and Performance Estimation Technology
Hirohito Teraoka, General Manager, Business Development Department, Ni-MH Division, FDK Corporation
We have developed a Ni-MH battery for ESS. By using lifetime estimation technology, we can estimate valuable battery life for ESS. The simulation model is based on the kinetics and thermodynamics of electrochemical reactions, and offers an estimation of battery performance after long-term storage.

4:05 Networking Refreshment Break

Battery Designs for Unique Applications

4:15 Transient Electronics: Energy Storage Solutions for Untraceable Applications and Hardware Security
Reza Montazami, Ph.D., Assistant Professor, Department of Mechanical Engineering, Iowa State University
Transient materials are an emerging class of materials designed to undergo fast and controlled disintegration on demand. Transient materials can be integrated with electronic circuits to enable transient electronics: electronic devices that disintegrate on demand. We present an overview of transient electronics along with our most recent findings on transient Li-ion batteries and an energy storage device enabling fully transient electronics for untraceable application and hardware security.

4:45 Development of Microbatteries for Implantable Applications
Yuxing Wang, Ph.D., Postdoctoral Research Associate, Energy and Environment Directorate, Pacific Northwest National Laboratory
Micro-acoustic transmitters are very promising devices to track biology activities. However, their lifetime is largely limited by the reduced energy densities in microbatteries used in these devices. At PNNL, small-size, lightweight and high-energy density microbatteries were custom designed and developed. In this talk, we discuss the challenges of producing millimeter-scale batteries and present our solutions. Performances of batteries fully integrated in acoustic transmitters are highlighted.

5:15 Battery Design, Selection and Evaluation for High Criticality Applications – Perspectives from the Medical Device Industry
Gaurav Jain, Ph.D., Senior Research Manager, Medtronic Energy and Component Center
Batteries are a critical component of a wide variety of medical devices and impact device safety, reliability, performance, size and cost. In the past, there was limited overlap in goals and requirements for batteries for medical versus non-medical applications. Examples from in-the-body (implantable), on-the-body (wearable) and for-the-body (powered surgical) applications, battery product development and reliability assessment will be shared in this presentation.

5:45 Close of Conference

Cambridge EnerTech
A Division of Cambridge Innovation Institute

Power Applications for Consumer Electronics

Overcoming the Challenges to Commercialization of Batteries for Portable Devices

WEDNESDAY, MARCH 22

11:10 am Conference Registration Open

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

Plenary Keynote Program

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2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

OEM Application Driven Development

3:40 Organizer's Opening Remarks

Craig Wohlers, Executive Director, Conferences, Cambridge EnerTech

3:45 Chairperson's Remarks

Kamal Shah, Director, Extended Battery Life Enabling Initiative, Intel Corporation

3:50 Practical Considerations for Miniature Li-Ion Batteries

Lawrence Pan, Ph.D., Principal Battery Engineer, Advanced Technology Team, Electrical Engineering, Fitbit

Miniature secondary batteries for wearable devices have unique considerations for implementation. The small physical size and capacity demand special attention in many aspects of design, manufacturing, pack assembly, protection, compliance, and validation. These inherent limitations and advantages are explored in contrast to larger secondary batteries found in phones, tablets, and laptops.

4:20 Changes in User Behavior in the PC+ Era

Jeremy Carlson, Battery Technology Engineer, Lenovo

In the PC+ era users are interacting with PCs in a different manner than they did 5 years ago. With the increase of Bring Your Own Device in the workplace, 2-in-1 devices and constant connectivity the role of the notebook PC has changed. We'll explore the changes in user behavior, the data supporting the analysis and the impact this could have on battery requirements for future devices.

4:50 Battery Applications for the Home: Diverse Requirements and Possibilities

John Wozniak, President, Energy Storage and Power Consulting

Cell and battery pack makers have been searching for more profitable applications as the tablet and notebook PC markets become commoditized. Power tools, portable home appliances and Smart Home applications are all areas of interest. How do these applications differ from traditional consumer electronics? What applications show potential for profitability and growth? This presentation will investigate the answers to these questions and more.

Power Applications for Consumer Electronics

5:20 **Sponsored Presentation** *(Opportunity Available)*

5:35 **Networking Reception in Exhibit Hall with Poster Viewing**

6:30 **Close of Day**

THURSDAY, MARCH 23

7:45 am **Registration Open**

7:45 **Interactive Breakout Discussion Groups with Continental Breakfast (See website for details.)**

8:45 **Session Break**

OEM Application Driven Development (Cont.)

9:00 **Chairperson's Remarks**
John Wozniak, President, Energy Storage and Power Consulting

9:05 **Insights into Optimizing Battery Design to Create Value and Improved Performance for Consumer Products**
Lisa King, Senior Engineering Manager, Battery Technology, Stanley Black & Decker
Stanley Black and Decker is the home of market-leading storage, hand tool, consumer home, outdoor and tradesman products, professional power and automotive tool brands. Research feedback shapes the innovation, design and physical testing of the products to be launched into the market. The shift from Ni-Cad to Li-ion technology has enhanced customer-desired features such as convenience, portability, longer run time, shorter charge time and power, particularly in the home products and outdoor spaces.

9:35 **Considerations in Adopting Battery Innovation**
Bruce Miller, Senior Engineer, Development, Battery Team, Dell
Every year new technologies, whether incremental or substantial, are made available to the marketplace. When each is announced, in most organizations the immediate question is: "Should we embrace and commit to this technology for our products". The technical and non-technical elements that go into such a decision will be discussed.

10:05 **Simplified Platform Power Measurement Using USB Type C Measurement Device**
Kamal Shah, Director, Extended Battery Life Enabling Initiative, Intel Corporation
Battery life remains a top purchasing criteria for mobile device end users. For the platform engineers, battery life analysis is a key engineering need. This presentation will provide an overview of the USB type C* interface, its support for power delivery, and how a simple platform power measurement device designed leveraging the USB Type C* interface can be a useful tool for platform power analysis. (*USB type C: property of their respective trade mark owners.)

10:35 **Coffee Break in the Exhibit Hall with Poster Viewing**

Innovation & Design in Next-Gen Consumer Electronics Applications

11:20 **Ultra-High Energy Density Anode Materials for Next-Generation Lithium-Ion Batteries for Consumer Electronics Applications**
Nikhil Koratkar, Ph.D., John A. Clark & Edward T. Crossan Endowed Chair Professor of Mechanical Engineering & Materials Science, Rensselaer Polytechnic Institute
The talk will discuss high energy density alternatives to graphitic carbon anodes in lithium-ion batteries. This will include defect-engineered graphene, silicon, phosphorene as well as composites of silicon-carbon as well as phosphorene-carbon. In addition to the often discussed gravimmetric energy density, attention will also be given to volumetric performance parameters which are crucial for portable electronics.

11:50 **Large-Scale, Thin-Film Batteries**
James Kaschmitter, CEO and Founder, SpectraPower LLC
Micro-batteries, made using high speed sputtering processes developed by Demaray LLC, have demonstrated remarkable cycle life (5,000 – 50,000 cycles) and very high energy densities. These processes have recently been scaled to large area formats, such as flat screen televisions and window films, and are now being applied to cost-effectively sputter thin, solid-state anodes and electrolytes. SpectraPower is integrating these films with its ultra-high energy cathode to produce large, thin-film batteries (>5Ahr).

12:20 pm **Sponsored Presentation** *(Opportunity Available)*

12:50 **Session Break**

1:00 **Networking Luncheon (All Are Welcome)**

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2:00 **Dessert Break in the Exhibit Hall with Poster Viewing**

Innovation & Design in Next-Gen Consumer Electronics Applications (Cont.)

2:30 **Chairperson's Remarks**
James Kaschmitter, CEO and Founder, SpectraPower LLC

2:35 **3rd Generation Separators: Using Thermally Stable Separators to Turn the Aluminum Current Collector into a Fuse**
Brian Morin, President & COO, Dreamweaver International
Recent battery safety events will soon be avoidable thanks to a new generation of separators that are being developed by five different companies. The new generation of separators are stable to over 300 C, a point at which the aluminum current collector oxidizes quickly enough to quench thermal runaway before it "runs away." This is a completely new paradigm for safety inside a lithium ion cell. These third generation separators will be presented, and also a teardown of a cell from a Samsung Galaxy Note 7.

Power Applications for Consumer Electronics

3:05 *In situ* Study of Strain-Dependent Ion Conductivity of Stretchable Polyethylene Oxide Electrolyte

Bahar Moradi-Gahdi, Department of Mechanical Engineering, University of Houston

There is a strong need in developing stretchable batteries that can accommodate stretchable or irregularly shaped applications including medical implants, wearable devices and stretchable electronics. There has been a fair amount of work exploring the development and performance of stretchable electrodes, but very little for stretchable electrolytes. The present work confirms the feasibility of using solid polymer PEO as a stretchable electrolyte for next generation stretchable batteries.

3:35 Replacing Lithium-Ion Batteries in Consumer Applications

Charles Resnick, President , ZapGo

Zapgo is developing Carbon-Ion (C-Ion) cells using nano-carbons and ionic electrolytes that have the potential to replace lithium-ion batteries in consumer applications with technology that is much faster charging and much safer. The company has already developed a powerbank mobile phone charger that charges in 5-minutes and can be shipped with none of the shipping restrictions that apply to lithium-ion.

4:05 Networking Refreshment Break

4:15 Transient Electronics: Energy Storage Solutions for Untraceable Applications and Hardware Security

Reza Montazami, Ph.D., Assistant Professor, Department of Mechanical Engineering, Iowa State University

Transient materials are an emerging class of materials designed to undergo fast and controlled disintegration on demand. Transient materials can be integrated with electronic circuits to enable transient electronics: electronic devices that disintegrate on demand. We present an overview of transient electronics along with our most recent findings on transient Li-ion batteries and an energy storage device enabling fully transient electronics for untraceable application and hardware security.

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Gaurav Jain, Ph.D., Senior Research Manager, Medtronic Energy and Component Center

Batteries are a critical component of a wide variety of medical devices and impact device safety, reliability, performance, size and cost. However, with the growing criticality of batteries in consumer products and long lifetime needs of automotive and ESS applications, perspectives from the medical device batteries are relevant for the broader battery industry. Examples from implantable, wearable, and powered surgical applications, battery product development and reliability assessment will be shared in this presentation.

5:45 Close of Conference

Battery Safety

Exploring Improved Methods to Achieve Increased Safety

MONDAY, MARCH 20

7:00 am – 4:00 pm Tutorial* Registration Open

7:00 – 8:00 am Morning Coffee

8:00 – 4:00 Pre-Conference Tutorials*

12:30 – 1:30 pm Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

1:30 – 2:00 Networking Refreshment Break

*** See page 4 for Tutorial details. Separate registration required for Tutorials.**

TUESDAY, MARCH 21

7:30 am Registration and Morning Coffee

Battery Safety & Regulation

8:30 Organizer's Opening Remarks
Craig Wohlers, Conference Director, Cambridge EnerTech

8:35 Chairperson's Remarks
Ted J. Miller, Manager, Energy Storage and Materials Strategy and Research, Ford Motor Company

8:40 Progress in Battery Safety Performance Simulation
Ted J. Miller, Manager, Energy Storage and Materials Strategy and Research, Ford Motor Company
Advanced automotive batteries are the critical enabling technology for vehicle electrification. Ford has undertaken development of a battery safety simulation tool. This is a first-of-its-kind multi-physics (combined mechanical, electrical, electrochemical, and thermal) CAE tool to predict battery response to a range of abuse conditions including crush due to crash and/or battery regulatory tests, short circuit, overcharge, and thermal ramp. An update on development progress and results from the alpha version of the prototype tool will be presented.

9:10 U.S. Department of Energy Electric Vehicle Battery Research Pathways and Key Results
Brian Cunningham, Engineer, Vehicle Technologies Office, Energy Storage R&D, U.S. Department of Energy
The U.S. Department of Energy set key technical targets necessary to enable Electric Vehicles (EV) to be as affordable as gasoline vehicles by 2022. A focus of this effort is the development of more cost-effective, longer lasting, and more abuse-tolerant EV batteries. VTO's battery R&D effort includes multiple activities, ranging from battery materials research to battery cell and pack development and testing. This paper will highlight the current battery R&D pathways supported by VTO and key technical results from 2016.

9:40 International Compliance for Li-Ion Batteries
Cynthia Millsaps, President and CEO, Quality, Energy Assurance LLC
International compliance for Li-ion batteries is not as straightforward as some other product categories. We will discuss transportation, mandatory and voluntary testing and certification requirements. It will include marks of conformity that are needed as well as look at common issues that arise during the process.

10:10 Networking Coffee Break

10:45 Roadmap for Lithium Battery Testing in Support of Safe Transportation
Steve Hwang, Ph.D., Chemist, Pipeline & Hazardous Materials Safety, US Department of Transportation
This presentation will focus on performance testing standards for use to make a decision and their broad international acceptance. Even with the seemingly redundant progresses in tests, incidents and thermal runaways still occur to make safety in all transportation environments questionable. Establishing a holistic approach may require evaluating present policy, practice and regulation, a challenge so complex and broad in scope that international cooperation is imperative. The question is where do we go next?

11:15 Battery Transportation: Shipping Requirements and Safety Mitigation
Thomas (TJ) Leech, III, CHMM, FedEx Express
The latest regulations and unique FedEx lithium battery shipping requirements will be reviewed, along with aircraft safety and mitigation methods.

11:45 Fire Protection for Lithium-Ion Batteries
Michael Greiner, President, Hazard Control Technologies
Encapsulator Agents are the only proven technology to extinguish lithium-ion battery fires, tested by Bosch, Dekra, Deutsche ACCUmotive, Daimler (Mercedes-Benz) and several other automotive companies. Encapsulator Agents are mixed with water and delivered from fire hoses or fixed suppression systems. Encapsulator Agents have an amazing ability to cool lithium-ion batteries, preventing reignition. The addition of an Encapsulator Agent will use 4-5 times less water to extinguish a lithium-ion battery fire.

12:15 pm Sponsored Presentation *(Opportunity Available)*

Battery Safety

12:30 **Session Break**

12:40 **Networking Luncheon (All Are Welcome)**

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1:40 **Networking Refreshment Break**

Tools for Risk Assessment & Mitigation

2:10 **Chairperson's Remarks**
Brian Barnett, Ph.D., Vice President, CAMX Power

2:15 **FEATURED PRESENTATION: Applications of Internal Short Circuit Detection and Examples of Early Implementations**
Brian Barnett, Ph.D., Vice President, CAMX Power
Recent events have heightened awareness that internal short circuits are a major cause of Li-ion battery safety events. We have developed multiple, distinct, non-invasive and chemistry-agnostic technologies for sensitive early detection of internal shorts in Li-ion batteries before the shorts pose a thermal runaway threat. We are implementing short detection for several applications and will describe examples of its use and benefits.

2:45 **Modeling Mechanical Failure of Lithium-Ion Batteries to Improve Battery Safety**
Shriram Santhanagopalan, Ph.D., Engineer, Transportation and Hydrogen Systems Center, National Renewable Energy Laboratory
In order to better understand the behavior of lithium-ion batteries under mechanical abuse, a coupled modeling methodology encompassing the mechanical, electrical and thermal response is presented for predicting short-circuit under external crush. Predicted damage of the individual layers within the cell under an indentation test are compared against experimental results. The electrical-thermal simulation predicts the current density and temperature distribution in a reasonable manner.

3:15 **Sponsored Presentation** *(Opportunity Available)*

3:45 **Grand Opening Refreshment Break in the Exhibit Hall with Poster Viewing**

4:30 **Monitoring the Strain Evolution of Lithium-Ion Battery Electrodes Using an Optical Fiber Bragg Grating Sensor**
Chang-Jun Bae, Senior Researcher, Korea Institute of Material Science, (KIMS), formally working at Palo Alto Research Center (PARC)
More advanced characterization and developmental tools are essential to improve performance and safety of Li-ion batteries. As a practical solution for *in situ* monitoring of realistic battery cells, we have implanted fiber optic sensors within the individual electrodes to monitor the internal electrode strain during cycling, demonstrating the feasibility and utility of FBG sensors to be used as diagnostic tools.

5:00 **Using Instrumented Li-Ion Batteries to Understand Battery Performance**
Rohit Bhagat, Associate Professor, University of Warwick
We present our work related to embedding sensors within commercially available cylindrical format cells. The types of sensors include reference electrodes for measuring half-cell voltages during operation and optical fibres to measure thermally induced strain. Embedding these sensors is not trivial as the performance of the cell must be unaffected by the modifications. The embedded sensors must survive the cells' internal environment. These instrumented cells are a powerful tool to investigate battery performance such as fast charging and aging.

5:30 **Transition to Breakout Discussions**

5:35 **Interactive Breakout Discussion Groups (See website for details.)**

6:35 **Welcome Reception in the Exhibit Hall with Poster Viewing (*Sponsored by* Shanghai Energy)**

7:30 **Close of Day**

WEDNESDAY, MARCH 22

8:00 am **Registration and Morning Coffee**

Modeling for Safety

8:20 **Chairperson's Remarks**
Ahmad Pesaran, Ph.D., Group Manager, Energy Storage Group, National Renewable Energy Laboratory

8:25 **Redox Shuttle Additives towards Safer Lithium-Ion Batteries**
Lu Zhang, Scientist, Energy Storage Research, Argonne National Laboratory
In this talk, a molecular engineer approach of redox shuttle molecules will be discussed, which will introduce the stepwise evolution of ANL family of redox shuttle additives that have been developed at Argonne National Laboratory. Quite a few additives will be discussed in detail to exemplify the development progress. For instance, ANL-8 was developed by asymmetrical incorporation of ether chain to the dimethoxybenzene base. Due to its asymmetric structure and strong polarity, ANL-8 is liquid at room temperature, which dramatically improves its solubility and overall compatibility. ANL-8 delivers excellent overcharge protection to LFP lithium-ion cells.

8:55 **Mechanical Abuse Tolerant Li-Ion Batteries**
Michael Naguib, Research Staff, Materials Science and Technology, Oak Ridge National Laboratory
Herein a new electrode design, guided by modeling, that is intended to reduce the likelihood of thermal damage in the event of mechanical abuse will be discussed. A proof-of-concept showed that upon impact or deformation, such as in a vehicle accident, batteries' electrodes break into electrically isolated segments limiting the current, therefore thermal-runaway can be avoided.

Battery Safety

9:25 Coffee Break in the Exhibit Hall with Poster Viewing

10:10 Modeling for Safety
Ahmad Pesaran, Ph.D., Group Manager, Energy Storage Group, National Renewable Energy Laboratory

10:40 Late Breaking Presentation

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

Plenary Keynote Program

12:40 pm Opening Remarks

12:45 Battery Innovator Award

12:55 Gigafactory Material Sourcing and Cell Production

Kurt Kelty, Senior Director, Cell Supply Chain & Business Development, Tesla Motors
This presentation will examine the status on material sourcing and sustainable material sourcing for the Gigafactory. In addition, the production of cells for energy products manufactured at the Gigafactory including the Powerwall and Powerpack will be discussed.

1:25 Surprising Chemistry in Li-Ion Cells

Jeff Dahn, Ph.D., FRSC, Professor of Physics and Atmospheric Science, NSERC/Tesla Canada Industrial Research Chair, and Canada Research Chair, Dalhousie University
It is important to increase the operating voltage of NMC Li-ion cells to obtain higher energy density. However, the electrolyte reacts with the positive electrode at high voltage. Using simple experiments involving only pouch bags, we show that the products of these reactions are extremely harmful to the positive electrode. This talk demonstrates how these harmful reactions at the positive electrode can be virtually stopped, leading to superb NMC Li-ion cells that can operate at high potential.

1:55 Advances within the BYD EDV Program and Its Technology

Xi Shen, Ph.D., Senior Director and General Manager, BYD EDV Batteries, China
WenFeng Jiang, Ph.D., R&D General Manager, BYD EDV Batteries, China
The high demand EDV for transportation worldwide has created significant market opportunities for BYD. Since the earlier F3DM and E6, BYD has broadly expanded its EDV business and technology to various fields including public transportation (e6 and E-bus), private transportation (Qin, Tang, etc.) and special transportation (forklift, city logistics vehicle, city cleaning vehicle, etc.) This talk shares the progress of the EDV program.

2:25 Charging Forward: Explosive Global Growth in the Battery Industry – Opportunities and Challenges Ahead

Christina Lampe-Onnerud, Ph.D., CEO, Founder, Chairman, Cadenza Innovation, LLC; Founder, Boston Power
This talk will highlight insights on the emerging global ecosystem that is rapidly developing complex systems and opening doors to innovators who are teaming up with established battery and non–battery players. The presentation will inspire the audience to stay true to data and yet push the design envelope for high performance, low cost, safe energy storage solutions.

2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

3:40 End of Conference

Battery Management Systems

Engineering Reliability and Robustness

WEDNESDAY, MARCH 22

11:10 am Conference Registration Open

11:10 Luncheon Presentation *(Sponsorship Opportunity Available)* **or Enjoy Lunch on Your Own**

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2:55 Refreshment Break in the Exhibit Hall with Poster Viewing

Understanding Wear & Abuse

3:40 Organizer's Opening Remarks

Victoria Mosolgo, Associate Conference Producer, Cambridge EnerTech

3:45 Chairperson's Remarks

Craig Arnold, Ph.D., Director, Princeton Institute for the Science and Technology of Materials, Princeton University

3:50 Mechanical Phenomena and Their Effects on Electrochemical Performance in Li-Ion Battery Systems

Craig Arnold, Ph.D., Director, Princeton Institute for the Science and Technology of Materials, Princeton University

Lithium-ion batteries are well-known to experience mechano-electrochemical phenomena and in this presentation, we discuss how the evolution of internal and external mechanical stress is coupled to electrochemical performance over the life of a battery. We will explore effects of mechanical and electrochemical localization which accumulate over many cycles and lead to accelerated aging and the onset of lithium dendrite growth.

4:20 Looking Inside Batteries – An Investigation into Dendrite Behavior

Laura Xing, Ph.D., Research Scientist, Center for Advanced Life Cycle Engineering (CALCE), University of Maryland

Dendrites are known to be one cause of failures in Li-ion batteries. To enable *in situ* observations and assess dendrite growth as a function of current density, temperature and electrolyte compositions, an optical cell was developed. Results of the dendrite formation, morphologies and factor dependencies will be presented.

Battery Management Systems

4:50 Battery Management System Using Stress/Strain Information
Anna Stefanopoulou, Ph.D., Professor, Mechanical Engineering, University of Michigan
Maximizing the utilization of Lithium-ion batteries relies on accurate prediction of their complex electrochemical, thermal and mechanical behavior. In this presentation, we will highlight key innovations for such a predictive battery management system. Application of these techniques in robotic and automotive applications will be presented.

5:20 Sponsored Presentation *(Opportunity Available)*

5:35 Networking Reception in Exhibit Hall with Poster Viewing

6:30 Close of Day

THURSDAY, MARCH 23

7:45 am Registration Open

7:45 Interactive Breakout Discussion Groups with Continental Breakfast (See website for details.)

8:45 Session Break

Novel BMS & Applications

9:00 Chairperson's Remarks
Girish Chowdhary, Ph.D., Director, Distributed Autonomous Systems Lab, Aerospace Engineering, University of Illinois at Urbana-Champaign

9:05 An Automated Battery Management System to Enable Persistent Missions with Multiple Aerial Vehicles
Girish Chowdhary, Ph.D., Director, Distributed Autonomous Systems Lab, Aerospace Engineering, University of Illinois at Urbana-Champaign
With most popular UAS (drones) having an endurance of less than 20 minutes, automated battery management systems have been envisioned as one way to increase mission endurance. In this talk, I will present our work on algorithms, software, and hardware for an automated battery management system that automatically tasks multiple UAS to enable long-endurance missions. The system has been demonstrated to enable missions exceeding 3 hours with 3 UAS which each has a single-charge flight time of 10 minutes.

9:35 Power Electronics Based Battery Energy Management Systems for Electric Transportation
Sheldon Williamson, Ph.D., Associate Professor, University of Ontario
This talk will illustrate how to enable aggressive usage while maintaining safety through the use of a power electronics based battery energy management system.

10:05 BMS Design for Lithium-Ion Batteries, A Holistic Approach
Tom Hoeger, Senior Power Systems Engineer, Naval Surface Warfare Center
With the proliferation of lithium-ion batteries, the BMS design has become as critical to battery safety and performance as cell selection. Designers often have a very narrow view as to what comprises the BMS resulting in excess complexity, reduced performance and failure to meet requirements. This discussion will identify the components making up the BMS, from battery cell to system level, and demonstrate utilizing this knowledge to produce an effective BMS and battery which meets performance and safety requirements.

10:35 Coffee Break in the Exhibit Hall with Poster Viewing

11:20 Battery Cycle Life Extension by Charging Algorithm to Reduce IOT Cost of Ownership
Naoki Matsumura, Ph.D., Senior Technologist, Intel
IOT devices expect Li-ion batteries to have a long cycle life because they may be used in areas where battery replacement is not easy. This session talks about a method to extend battery cycle life through battery charging algorithm. This is expected to reduce the cost of ownership as it enables less battery replacement.

11:50 Increased EV Utility Realized through Extreme Fast Charging (up to 350kW)
Christopher Michelbacher, Ph.D., Battery Performance & Research Design Scientist, Energy Storage & Transportation Systems, Idaho National Laboratory
The implementation of charging up to 350kW is expected to impact many technology areas. Four market pillars are identified (Battery Implications, Vehicle Implications, Infrastructure Implications, and Economic Feasibility) and within each subset, areas of interest specified. Through each market pillar, technology gaps were identified via a technology road-map which will serve as the first phase of evaluation and help focus future research decisions for a more impactful and timely release of technology and products to the market.

12:20 pm Sponsored Presentation *(Opportunity Available)*

12:50 Session Break

1:00 Networking Luncheon (All Are Welcome)

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2:00 Dessert Break in the Exhibit Hall with Poster Viewing

Modeling Safer Batteries

2:30 Chairperson's Remarks
Eric Darcy, Ph.D., Battery Technical Discipline Lead, Propulsion and Power Division, NASA-JSC/EP5

Battery Management Systems

2:35 Insights from Tests with an On-Demand Internal Short Circuit Device in 18650 Cell Designs

Eric Darcy, Ph.D., Battery Technical Discipline Lead, Propulsion and Power Division, NASA-JSC/EP5

The NREL/NASA device has been implanted in 2 cell designs with 3 more underway. We have learned that a tri-layer shutdown separator is effective at shutting down collector-collector shorts in a 2.4Ah cell design, but not anode to aluminum shorts. We also learned that sidewall ruptures can be induced when the device is located 3 winds into the JR though no sidewall ruptures occur with numerous circumferential heater TR tests. We will be assessing the benefits of the bottom vent in preventing sidewall ruptures with the device.

3:05 CO-PRESENTATION: Electric Vehicle Battery Prognostics and Health Management: Mobility and Durability

Jay Lee, Ph.D., Distinguished University Professor, University of Cincinnati

Mohammad Rezvani, Battery Systems Engineer, Workhorse Group Inc.

Analysis of lithium-ion battery raw data during charge/drive processes enables us to develop battery degradation models in multi-regime conditions to estimate SoH. When a battery reaches an unmanageable level of degradation, or before a failure takes place, the Smart Battery pack can recommend the best course of action or maintenance task, while also allowing the user to infer the best time to replace the battery.

3:35 Dramatically Improved Battery Safety with In-Cell Sensors and Actuators

Chao-Yang Wang, Ph.D., Professor & William E. Diefenderfer Chair, Mechanical Engineering, The Pennsylvania State University

I shall describe a highly robust and durable internal temperature sensor (ITS) enabling substantial improvement in the battery's high-temperature safety and thermal management. We show for the first time that our embedded ITS can survive more than 2,500 battery cycles or equivalently more than 25 years/250,000 miles of vehicle life. Such an ITS is particularly indispensable for large-size electric vehicle batteries as the response lag of the surface temperature behind the interior temperature grows substantially with the cell size.

4:05 Networking Refreshment Break

4:15 R&D: Cost Reduction & Energy Density Improvements: Manufacturing R&D for Low-Cost, High-Energy Density Lithium-Ion Batteries for Transportation Applications

David L. Wood, III, Ph.D., Roll-to-Roll Manufacturing Team Lead & Fuel Cell Technologies Program Manager, Energy & Transportation Science Division, Oak Ridge National Laboratory

Li-ion battery pack costs have dropped from ~$500-600/kWh to $275-325/kWh due to economies of scale, improvements in electrode and cell quality control, and more efficient production methods. However, more development on electrode processing cost reduction, coating deposition quality control, and cell assembly methods must occur to meet DOE ultimate pack cost of $125/kWh for battery electric vehicles (BEVs). Cell energy densities must still be increased 150-180 Wh/kg to 350 Wh/kg for sufficient BEV driving range.

4:45 KEYNOTE PRESENTATION: How to Significantly Increase Energy Density of Lithium-Ion Batteries without Changing Chemistry

Rachid Yazami, Ph.D., Professor and Principal Scientist, Energy Research Institute (ERIAN), Nanyang Technological University

Efforts to increase energy density of LIBs have been for the most part focused on developing anode and cathode materials with higher lithium storage capabilities and, for the cathode, higher operating voltages. This approach, however, may alter cycle life and safety. Here we disclose a new approach consisting on optimized utilization of full storage capability of anode and cathode. In fact, using thermodynamics measurements and analytical methods we found that in most commercial LIBs anode and cathode are used within a limited lithium composition range 20 to 40% below what is achieved in half cells. A strategy to enhance electrode utilization rate and, therefore, energy density by over 20% will be presented and discussed.

5:45 Close of Conference

Cambridge EnerTech
A Division of Cambridge Innovation Institute

HOTEL & TRAVEL INFORMATION

Conference Venue:
The Greater Ft. Lauderdale - Broward County Convention Center
1950 Eisenhower Boulevard
Fort Lauderdale, FL 33316
www.ftlauderdalecc.com

Host Hotel:
Hilton Fort Lauderdale Marina
1881 SE 17th Street Causeway
Fort Lauderdale, FL 33316
Phone: 954-463-4000

Reservations:
Go to the travel page of InternationalBatterySeminar.com

Discounted Room Rate:
$209 s/d (includes Complimentary Wi-Fi in Sleeping Room)

Discounted Cut-off Date:
February 17, 2017

Go to the travel page of InternationalBatterySeminar.com for additional info

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FORT LAUDERDALE, FL

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Pricing and Registration Information

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	Commercial	Academic, Government
All Access Late Registration Rate After February 17	$2,499	$1,649

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One Tutorial	$379	$279
Two Tutorials	$649	$479
Three Tutorials	$899	$649
Main Seminar Only Late Registration Rate After February 17	$1,799	$1,199

PROGRAM SELECTIONS

Tutorials: Monday	Main Seminar Tracks: Tues-Wed	Main Seminar Tracks: Wed-Thur
TUT1: Materials Selection and Design for Batteries with High Energy Density, Ultralong Cycle Life and Excellent Safety	T1A: Next-Generation Battery Research	T1B: Lithium-Ion Development & Commercialization
TUT2: Battery Safety Training		
TUT3: Battery Technology Evaluation and Commercialization Strategies	T2A: High Performance Battery Manufacturing	T1B: Lithium-Ion Development & Commercialization
TUT4: Technoeconomic Analysis of Battery Material Development and Manufacture	T3A: Advances in Automotive Power Applications	T2B: Emerging Energy Storage Applications
TUT5: Recent Advances in Solid State Electrolytes for Energy Storage		
TUT6: LIB Reuse & Recycle		T3B: Power Applications for Consumer Electronics
TUT7: Advancements in Wireless Charging: Applications, Standards & Integration		
TUT8: The Rechargeable Battery Market: Value Chain and Main Trends 2017 – 2027	T4A: Battery Safety	T4B: Battery Management Systems
TUT9: Improving the Energy Density of Batteries with Silicon-Based Anodes		

POSTERS

The International Battery Seminar & Exhibit encourages attendees to gain further exposure by presenting their work in the poster sessions. To secure a poster board and inclusion in the conference materials, your abstract must be submitted, approved and your registration paid in full by February 17, 2017.

Reasons you should present your research poster at this conference:

- Network with interested attendees and speakers during multiple dedicated poster viewing sessions
- Your poster abstract will be published in our conference materials
- Your research will be seen by leaders from top commercial, academic and government institutes

How to Register: **InternationalBatterySeminar.com**

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ADDITIONAL REGISTRATION DETAILS

Want to Register by Phone?

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Ways to SAVE!

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