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Plenary Keynote Presentations



Progress Toward 4.7 V NMC Li-Ion Cells with High Energy Density
Jeff Dahn, Ph.D., Professor,
Department of Chemistry, Dalhousie University



Alkali-Metal Anodes with a Solid Electrolyte
John Goodenough, Ph.D., Virginia H. Cockrell
Centennial Chair in Engineering, Professor,
University of Texas at Austin



Global Electrification and LG Chem
Denise Gray, CEO,
LG Chem Power, Inc., Korea



The Gigafactory - Manufacturing Batteries Based on First Principles Approach at the World's Largest Battery Factory
Kurt Kelty, Director, Battery Technology, Tesla Motors



Balancing Act - Energy Storage Solutions to Meet Government, Consumer and Automaker Demands
Craig Rigby, Advanced Market & Technology Strategist,
Johnson Controls

Conference Founder & Program Advisor
Dr. S.P. Wolsky, Ansum Enterprises, Inc.

March 21-24, 2016

Fort Lauderdale Convention Center
Fort Lauderdale, FL

FINAL AGENDA

Conference Programs

TRACK 1

BATTERY
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TRACK 2

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TRACK 3

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PLENARY AGENDA

MONDAY, MARCH 21

4:20 Event Chairperson's Opening Remarks

4:25 Plenary Session Introduction
(Sponsorship Opportunity Available)



4:35 Opening Plenary Keynote: The Gigafactory: Manufacturing Batteries Based on First Principles Approach at the World's Largest Battery Factory

Kurt Kely, Director, Battery Technology, Tesla Motors

Battery raw materials are being sourced from earth to factory in the most efficient, streamlined way possible, minimizing environmental footprint and cost. Less processing, logistical and transport steps are used in the supply chain. Full lifecycle engineering methodologies are employed to keep cost low and environmental impact minimal.

5:15 Keynote Panel Discussion: Lithium Ion – A Global Perspective on Products Positioned to Transform the Market

This key plenary panel will examine lithium ion battery applications within the automotive and portable markets. Our distinguished panel of experts will discuss which specific applications have the most potential to become market changing. Experts from around the world will provide their insight and opinion on the direction of global lithium ion applications and where they see the most potential for growth.



Moderator:
Susan Babinec,
*Senior Commercialization Advisor, ARPA-E,
U.S. Department of Energy*

Panelists:



Jason Howard, Ph.D.,
*Distinguished Member
of the Technical Staff,
Advanced Energy
Technologies - Energy and
Power Management Technology,
Motorola Mobility*



Dennis Malec,
*Senior Applications
Engineer, Panasonic*



Henry Mao, Ph.D.,
*CEO, Youllion Battery,
Ltd., China*



Ted Miller,
*Senior Manager,
Energy Storage and
Materials Strategy
and Research, Ford Motor
Company*



**Ahmad A. Pesaran,
Ph.D.,**
*Manager, Energy
Storage Group,
Transportation and
Hydrogen System Center,
National Renewable Energy
Laboratory (NREL)*



**Mark Verbrugge,
Ph.D.,**
*Director, Chemical
and Materials
Systems Laboratory,
General Motors*

TUESDAY, MARCH 22

8:00 Event Chairperson's Opening Remarks

8:05 Battery Innovator Award

8:20 Plenary Session Introduction *(Sponsorship Opportunity Available)*



8:30 Plenary Keynote 1: Progress toward 4.7V NMC Li-ion Cells with High Energy Density

*Jeff Dahn, Ph.D., Professor, Department of Physics and Atmospheric Science,
Dalhousie University*

NMC-based Li-ion cells are being used in electric vehicles and grid energy storage by some firms. To obtain long cycle and calendar life, the cells are normally charged to only 4.1 or 4.2 V. There are substantial energy density gains available and a potential for cost reduction if NMC-based Li-ion cells can be charged to higher voltage without compromising lifetime. This lecture will describe the problems associated with high voltage NMC cells and the steps we, and others, are taking to try to overcome the problems.



9:05 Plenary Keynote 2: Alkali-Metal Anodes with a Solid Electrolyte (this talk will be done as a live webcast)

*John Goodenough, Ph.D., Virginia H. Cockrell Centennial Chair in Engineering,
Professor, University of Texas at Austin*

Presentation delivered via a live, interactive video conferencing platform.

Plating of an alkali-metal anode from a liquid electrolyte is plagued by dendrite formation and growth. Plating of an alkali-metal anode through a solid electrolyte without dendrite formation requires a solid-electrolyte surface that is wet by the alkali metal and makes a solid-solid interface that is stable on charge/discharge cycling. An anode with no alkali metal requires an insertion compound, an alloy, or a conversion compound having a Fermi energy far enough below that of the alkali metal, that the alkali metal is not plated during a fast charge. Anodes with a Fermi energy above the electrolyte LiMO undergo formation of a passivating solid-electrolyte interphase (SEI) at the anode surface that conducts the working ion robbed from the cathode. What is the best anode strategy?

WEDNESDAY, MARCH 23

9:00 Event Chairperson's Opening Remarks

9:05 Plenary Session Introduction *(Sponsorship Opportunity Available)*



9:15 Plenary Keynote 3: Balancing Act - Energy Storage Solutions to Meet Government, Consumer and Automaker Demands

Craig Rigby, Advanced Market and Technology Strategist, Johnson Controls

With an increasing spectrum of battery technologies in development, automakers have more choices than ever before to meet their short- and long-term energy storage needs. But the realistic market adoption of any of these technologies depends on creating a low cost solution that can be deployed across high volume. In this session, we'll explore market opportunities and growth; drivers of successful adoption; application needs; product attributes; and economics.

5:05 Event Chairperson's Introduction



**5:10 Closing Plenary Keynote:
Global Electrification and LG Chem**

Denise Gray, CEO, LG Chem Power, Inc.

A review of the current global trends in vehicle electrification and automotive battery technologies will be presented. This will be carried out highlighting LG Chem's participation in the various segments from materials, cell and cost points of view.

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TUTORIALS*

MONDAY, MARCH 21

8:00 - 10:00 AM

TUT1: The Rechargeable Battery Market: Value Chain and Main Trends 2016 - 2026

Instructor:
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, 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 2016-2026 will be discussed

10:30 AM - 12:30 PM

TUT2: Materials Selection and Design for Batteries with High Energy Density, Ultralong Cycle Life and Excellent Safety

Instructor:
Yi Cui, Ph.D., Associate Professor, David Filo and Jerry Yang Faculty Scholar, Materials Science and Engineering, Stanford University

This tutorial gives an overview on 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, and P anodes and S cathodes for high energy batteries, which offers 7-10 times higher lithium ion storage capacities. 2) Low cost Prussian-blue based materials and Li metal-polysulfide semiflow batteries for grid scale storage. 3) A smart separator to enhance battery safety. 4) Solid-state nanocomposite polymer electrolyte with enhanced ionic conductivity.

TUT3: Battery Safety Training

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

Batteries become daily use components for many applications. More than that, we can say that without batteries our life will 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. This training program 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 for over 25 years of work in the field. The motivation behind the training is to provide training attendees with the knowledge needed to safely handle the batteries in their organization and to support reduction in safety events. Key benefits include full review of root cause for battery safety events, guidelines on how to handle batteries safely, what-to-do guidelines in case of battery safety events, checklist of safety equipment needed and fresh and updated knowledge about battery safety.

TUT4: EV Battery Recycling Technology: Challenges and Opportunities

Instructors:
Linda Gaines, Ph.D., Systems Analyst, Argonne National Lab

Steve Sloop, Ph.D., President, On-To Technology

This tutorial will summarize the current status of recycling, for both consumer electronic and automotive batteries, and proceed to describe technical and institutional factors that could enhance or impede future recycling success. It will address the special challenge of recycling automotive Li-ion batteries into viable products at a reasonable cost and within the bounds of environmental, health, and safety regulations. Ideally, recycling will also reduce both demand for raw critical materials as well as energy and environmental impacts of production. This tutorial will examine the potential of current and developmental recycling processes to meet these goals.

2:00 - 4:00 PM

TUT5: Recent Advances in Solid State Electrolytes for Energy Storage

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

Chunsheng Wang, Ph.D., Associate Professor, Department of Chemical & Biomolecular Engineering, University of Maryland

Kang Xu, Ph.D., Senior Research Scientist,

Electrochemistry Branch, U. S. Army Research Laboratory

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: Technoeconomic Analysis of Battery Material Development and Manufacture

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

Thomas D. Gregory, Owner, Borealis Technology Solutions LLC

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.

TUT7: Batteries for Medical Devices: Bridging Design, Manufacturing & Regulations

Instructors:
Rich Byczek, Global Technical Lead, Electric Vehicle & Energy Storage, Intertek Transportation Technologies
Richard Nass, Executive Vice President, Embedded & IoT Franchises, OpenSystems Media

Jeffrey V. Ortega, Ph.D., Director, Research, R&D, ZPower, LLC

As portable medical devices continue to proliferate, the need for longer battery life becomes paramount. That phenomenon dovetails with the need for safer and lighter cells (and chemistries). Instructors during the Batteries for Medical Devices tutorial will address current and future market trends; research, design, and manufacturing techniques and technologies; testing and standardization; and regulatory compliance for current and future medical applications.

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| AIGOLION Ltd, CEO | Duracell, Dir R&D | Motorola Solutions Inc, Sr Category Mgr | Tesla Motors, Sr Mgr |
| Apple Inc, Battery Dev Scientist | Energizer, Assoc Fellow | Robert Bosch Battery System LLC, Dir Engineering | Texas Instruments Inc, Head of Algorithm Dev; Chief Technologist |
| BMW Group, Research Battery Tech | EVE Energy Co Ltd, Deputy GM | SAFT America Inc, Li Ion Chem Mgr | Toyota Motor Engineering & Mfg, Engineer |
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For more information, please contact:

Sherry Johnson

Manager, Business Development

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TRACK 1: MARCH 21-23, 2016

BATTERY R&D

Advances in Material, Chemical, and Electrical Engineering

MONDAY, MARCH 21

7:00 am – 2:00 pm Tutorial* Registration and Morning Coffee

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

2:30 - 6:30 Main Conference Registration

4:20 Plenary Keynote Session (See page 2 for details)

6:25 Welcome Reception in the Exhibit Hall with Poster Viewing

7:30 Close of Day

*See page 3 for Tutorial details.

TUESDAY, MARCH 22

7:00 am Registration and Morning Coffee

8:00 Plenary Keynote Session/Battery Innovator Award

9:40 Coffee Break in the Exhibit Hall with Poster Viewing

ALTERNATIVE MATERIALS AND CHEMISTRIES

10:15 Organizer's Opening Remarks

Mary Ann Brown, Executive Director, Conferences, Cambridge EnerTech

10:20 Chairperson's Remarks

M. Stanley Whittingham, D.Phil., Director & Distinguished Professor, Chemistry and Materials, Binghamton University

10:25 Would Materials-Based Advancement in Magnesium Battery Make It Become a Contender?

Rana Mohtadi, Ph.D., Principal Scientist, Toyota

Driven by the need to access higher-energy densities beyond those offered by LIBs, rechargeable Mg batteries have been receiving increased interest. We have been pioneering the development of a new class of electrolytes based on a novel bottom-up design strategy that enabled overcoming several key challenges. We outline the current technology status while highlighting recent breakthroughs that offered a new turning point in magnesium battery R&D.

10:55 Energy Storage with Sodium-Ion Batteries

Chris Wright, D.Phil., Chairman, Faradion Ltd.

The non-aqueous sodium-ion battery has been demonstrated by Faradion to

be capable of comparable performance to systems based on lithium-ion. The presentation covers recent cycling data from Faradion's second-generation materials. In light of their performance and cost benefits, it also provides a perspective on those applications where sodium-ion chemistry is likely to be most competitive with other battery technologies.

» 11:25 FEATURED PRESENTATION: BEYOND LITHIUM-ION BATTERIES: VISION & PROGRESS

George W. Crabtree, Ph.D., Director, Joint Center for Energy Storage Research (JCESR), Argonne National Laboratory & Distinguished Professor of Physics, Electrical and Mechanical Engineering, University of Illinois at Chicago

Beyond lithium-ion batteries with factors of five, better performance and lower cost are needed to transform transportation and the operation of the electricity grid. The prospects and progress toward achieving these aggressive goals will be assessed.

11:55 Session Break

12:05 pm Networking Luncheon
(All Are Welcome)

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1:35 Dessert Break in the Exhibit Hall with Poster Viewing

ADVANCING LI-ION CHEMISTRIES

2:20 Chairperson's Remarks

George W. Crabtree, Ph.D., Director, Joint Center for Energy Storage Research (JCESR), Argonne National Laboratory & Distinguished Professor of Physics, Electrical and Mechanical Engineering, University of Illinois at Chicago

» 2:25 FEATURED PRESENTATION: NECCES - PUSHING THE FRONTIERS OF LI-ION BATTERIES

M. Stanley Whittingham, D.Phil., Director & Distinguished Professor, Chemistry and Materials, Binghamton University

Li-ion batteries today achieve less than 25% of their theoretical energy densities. The goal of NECCES is through a fundamental understanding to determine the causes of this and to "close the gap" between theory and practice. Several model compounds are being studied, including NCA/NMC for the layered oxides, and VOPO₄/Li₂VOPO₄ as a 2-Li high-energy system. Operando studies are key to understanding the reactions in real cells.

2:55 Ion Solvation Effects in the Nonaqueous Li-O₂ Electrochemistry

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

The objective of this presentation is to provide an assessment of challenges facing Li-O₂ batteries, including instabilities of the electrolyte and cathode, and Li₂O₂ electronic conductivity limitations. Results will be presented on the

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characterization of the Li_2O_2 formation mechanism and how the mechanism can be manipulated through electrolyte engineering to potentially alleviate problems associated with Li_2O_2 deposition on the cathode.

3:25 Innovations in Silicon-Dominant Anodes - Enevate's HD-Energy® Technology

Benjamin Park, Ph.D., Founder & CTO, Enevate Corporation

Enevate's HD-Energy® Technology allows for Li-ion cells with both high charge rates and high energy density, as well as other unique characteristics while still being sufficiently inexpensive and manufacturable. The novel technology includes silicon-dominant anodes (versus a silicon powder additive mixed into a graphite anode). Full-size cells and manufacturing processes have been developed for high volume commercial production and use in consumer devices. The special characteristics of the technology and test data will be presented.



3:55 Refreshment Break in the Exhibit Hall with Poster Viewing

4:30 Ternary Metal Fluorides as High-Energy Cathodes for Rechargeable Lithium Batteries

Feng Wang, Ph.D., Staff Scientist, Sustainable Energy Technologies, Brookhaven National Laboratory

Transition metal fluorides are promising high-capacity battery cathode for large-scale applications (i.e., electric vehicles), but issues related to low voltage, large hysteresis and limited cycling reversibility remain a major hurdle to their commercial application. Here we report on the novel ternary fluorides ($\text{Cu}_y\text{Fe}_{1-y}\text{F}_2$) as cathodes with high-energy density and small hysteresis (via enabling Cu redox). The electrochemical reaction mechanisms in $\text{Cu}_y\text{Fe}_{1-y}\text{F}_2$, in comparison to that in binary fluorides, will be discussed.

5:00 Exploring Various Electrolytes in Silicon-Containing Lithium-Ion Batteries

Steve Trask, Engineering Assistant, Chemical Sciences & Engineering Division, Argonne National Laboratory

This talk discusses the evaluation of silicon-graphite composite electrodes, developed at Argonne, with layered-oxide positive electrodes in cells containing various electrolyte systems. These systems include those with LiPF_6 and LiFSI salts and electrolyte solvent additives, such as vinylene carbonate (VC) and fluoroethylene carbonate (FEC). The full cell performance and degradation will be highlighted, along with complementary reference electrode testing that monitors electrode voltages and impedance changes, during cell aging.

5:30 Temperature Dependence of the Open Circuit Voltage Hysteresis Gap in Lithium-Iron-Phosphate Cells

Steven Miller, Ph.D., Mechanical Engineer, Energy Conversion R&D Branch, Machinery Research and Silencing Division, Naval Surface Warfare Center, Philadelphia Division (NSWC-PLD)

Li-ion batteries exhibit open circuit voltage hysteresis, a phenomenon where the open circuit potential curve is higher during recharge than during discharge. Tests of different Li-ion chemistries show that the size of this hysteresis voltage gap depends not only on temperature, but also the state of health of the cell. We conclude that the size of the gap is largely governed by transport kinetics.

6:00 Networking Reception in the Exhibit Hall with Poster Viewing

7:00 Close of Day

WEDNESDAY, MARCH 23

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

8:50 Session Break

9:00 Plenary Keynote Session (See page 2 for details)

9:50 Coffee Break in the Exhibit Hall with Poster Viewing

ADVANCED BATTERY MATERIALS

10:35 Chairperson's Remarks

Michael A. Fetcenko, Managing Director, BASF Battery Materials – North America

10:40 FEATURED PRESENTATION: REVIVING LITHIUM METAL ANODES WITH NEW MATERIALS DESIGN STRATEGIES

Yi Cui, Ph.D., Associate Professor, David Filo and Jerry Yang Faculty Scholar, Materials Science and Engineering, Stanford University

Lithium metal dendrite formation and side chemical reactions are key challenges for LIBs. Here I will discuss our recent new materials design strategies including: 1) inventing stable interfacial layers based on hollow carbon spheres, BN and graphene; 2) exploring synergistic effect of electrolyte additives and polysulfides for forming stable solid electrolyte interphase; 3) new strategies to mitigate the infinite relative volume expansion of lithium plating.

11:00 Advances in Application of Carbon Nanotubes for High-Energy and High-Power Lithium-Ion Batteries

Eva Yan, Vice President, Sales and Marketing, Cnano Technology Ltd.

Carbon nanotube (CNT)-based conductive additive can bring several significant improvements for lithium-ion batteries. It is increasingly adopted by Li-ion battery developers and manufacturers as the new-generation functional, conductive additive to improve performance, including high-voltage stability and lower cost for premium batteries. We present the latest study on the fundamental and practical factors which affect the effective usage of the various CNT products and the performance enhancement.

11:20 Exploitation of Carbon Nanostructures in Li-Ion Batteries: Perspectives from Science and Industry

Avetik R. Harutyunyan, Ph.D., Chief Scientist/Project Leader, Materials Science, Honda Research Institute USA Inc.

New carbon nanostructures aroused expectations of realizing high-energy density batteries with enhanced durability owing to their high surface-to-mass ratio, high electrical/thermal conductivities and mechanical properties. Despite these potentials there are fundamental scientific obstacles that hinder their broad applications. Feasibility of carbon nanostructures and their derivatives as Li-ion battery electrodes, main obstacles and their solutions will be discussed. Practical opportunities toward their industrial-scale applications will be presented as well.

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11:40 Long Term Cycling Performance and Conductivity Enhancement Characteristics of Lac Knife Flake Graphite from Quebec, Canada

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

Long Term Cycling tests were run on both uncoated and carbon coated Lac Knife spherical graphite in the anodes of CR2016 configured coin cells. Both the uncoated and coated SPG Lac Knife coin cells exhibited zero loss of capacity after 110 cycles. Tests run on two commercial grades of carbon coated SPG flake graphite exhibited capacity losses of 4% and 7% after 110 cycles.



11:55 Carbons for Mobile Energy Applications – an Overview

Luigi Alzati, Market Leader Americas, IMERYs Graphite & Carbon

An overview of Carbon solutions for Batteries and Energy Storage is presented. Carbon material typology and its function will be discussed with reference to Alkaline Batteries, Lead Acid Batteries and Lithium Ion Batteries.



12:10 pm Session Break

12:20 Networking Luncheon (All Are Welcome)



1:50 Dessert Break in the Exhibit Hall with Poster Viewing

ADVANCED BATTERY MATERIALS (CONT.)

2:45 Chairperson's Remarks

David Heacock, Senior Vice President & Manager, SVA, Texas Instruments

2:50 Structure-Property Relationships of Ceramic-Coated Separators

Richard W. Pekala, Sc.D., Vice President, Research & Development, ENTEK Membranes LLC

Ceramic coatings on microporous, polyolefin films have gained wide attention because of the special properties that they impart to lithium-ion battery separators. Such technology was originally pioneered in the 1990s by companies interested in inkjet receptive coatings. In this presentation, we discuss the factors that impact the dimensional stability, wettability, air permeability and mechanical properties of ceramic-coated separators.

3:20 Unlocking the High Rate Capability of Lithium-Rich Layered Metal Oxide Cathode Materials for Li-Ion Batteries

K.M. Abraham, Ph.D., FRSC, Professor, Northeastern University Center for Renewable Energy Technology, Northeastern University

Poor rate capability and excessive capacity fade during cycling have limited the practical utility of lithium-rich layered metal oxides of the formula $xLi_2MnO_3 \cdot (1-x)LiMO_2$, where M is a transition metal and $0 < x < 1$. We report discoveries to overcome these limitations including: i) judicious modification of the crystal structure of the layered oxides through metal doping; ii) preparation of a material with open porous morphology and higher electronic conductivity via a new synthetic method; and iii) a layered electrode architecture utilizing multi-wall carbon nanotubes. Discharge capacities of 200, 250, and 300 mAh/g at C, C/4 and C/20 rates, respectively, and little capacity fade during long-term cycling will be reported for the new materials.

3:50 Session Break with Light Refreshments

BMS SESSION TO HONOR DAVE FREEMAN

4:00 Full Realization of Fast Charge and Cycle Life Potential for Any Battery

Yevgen Barsukov, Ph.D., TI Fellow & Head of Algorithm, Battery Management Systems, Texas Instruments

From the introduction of Li-ion battery, CC/CV charging was providing a compromise between charge time and cycle life. However, given the progress in development of gauge controlled charger, pioneered by Dave Freeman, this compromise is no longer necessary. Using in-system half-cell-level modeling we can achieve fastest possible charge while minimizing degradation. We are proposing an industry roadmap for constant anode potential (CAP) charging that gives theoretically minimal charge-time without Li-plating.

4:20 Online Electrochemical Impedance Spectroscopy in Lithium-Ion Battery Packs

Reinhold Koch, Research Associate, TUM CREATE Ltd.

Online impedance measurements performed by the battery management system would provide better data to adapt the battery and energy management and would increase the accuracy of rest-of-lifetime estimations. Cost can be reduced by using already existing components to generate the excitation current. In order to perform the measurement during operation, corrections have to be applied and measurement time reduced.

4:40 Deploying Model-Based Control for Optimum xEV Pack Performance

John Millios, Ph.M., CEO, Sendyne

Many complex applications rely on model-based control; so could energy storage. Transitioning from equivalent circuit representations to physics-based battery models could provide superior insight in critical battery processes and, if deployed properly in a BMS, could improve the performance, longevity and utilization of battery packs. This presentation introduces a novel method for utilizing virtually any physical battery model for pack design as well as for control onboard the BMS.

5:00 Session Break

5:05 Closing Plenary Keynote Session (See page 2 for details.)

5:45 Close of Main Conference

6:15 Taste of Fort Lauderdale Dine Around

Network with fellow colleagues while sampling Fort Lauderdale's fabulous local cuisine along 17th Street Causeway. Mention INTERNATIONAL BATTERY and/or show your name badge at one of the specific restaurants listed and receive a special offer. See Hotel & Travel tab of Event website for more details.

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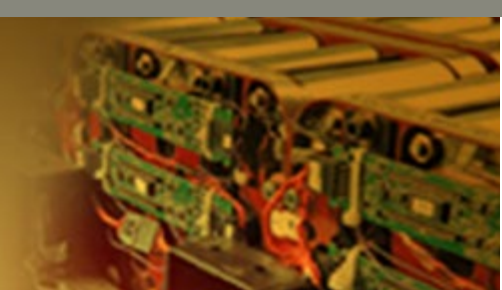
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TRACK 2: MARCH 21-23, 2016

BATTERY MANUFACTURING

Advances in Global Production of Lithium Batteries



MONDAY, MARCH 21

7:00 am – 2:00 pm Tutorial* Registration and Morning Coffee

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

2:30 - 6:30 Main Conference Registration

4:20 Plenary Keynote Session (See page 2 for details)

6:25 Welcome Reception in the Exhibit Hall with Poster Viewing

7:30 pm Close of Day

*See page 3 for Tutorial details.

TUESDAY, MARCH 22

7:00 am Registration and Morning Coffee

8:00 Plenary Keynote Session/Battery Innovator Award
(See page 2 for details)

9:40 Coffee Break in the Exhibit Hall with Poster Viewing

CHINESE BATTERY MANUFACTURERS

10:15 Organizer's Opening Remarks

Craig Wohlers, Executive Director, Conferences, Cambridge Enertech

10:20 Chairperson's Remarks

Jiqiang Wang, Ph.D., China Industrial Association of Power Sources, China

10:25 Fast Market Growth and R&D Progress of xEV Li-Ion Batteries in China

Jiqiang Wang, Ph.D., China Industrial Association of Power Sources, China

10:55 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.

11:25 Flow Battery Technology: Research Development and Application

Xianfeng Li, Ph.D., Professor, Division of energy storage, Dalian Institute of Chemical Physics, Chinese Academy of Science

Increasing attention for large scale energy storage has recently emerged, e.g. due to urgent needs in grid management (load levelling and peak shaving), as backup power, or for utilization and integration of renewable energy source. This presentation will give a detailed introduction on the updated research progress on flow batteries including the fundamental electrochemistry, key materials, components and systems. The challenge and prospective of flow batteries will be briefly summarized.

11:55 Session Break

12:05 pm Networking Luncheon
(All Are Welcome)

1:35 Dessert Break in the Exhibit Hall with Poster Viewing

CHINESE BATTERY MANUFACTURERS (CONT.)

2:20 Chairperson's Remarks

Jiqiang Wang, Ph.D., China Industrial Association of Power Sources, China

2:25 The Technology and Application Development of China's Lithium-ion Battery-Capacitor SPC

David He, Ph.D., EVE Energy Co., Ltd, China

To tackle the problems of low voltage platform, narrow working temperature, low energy density and unstable leakage current, EVE Energy Co., Ltd (EVE) created Lithium-ion Battery-capacitor equipped with the specific capacity features and the specific power characteristics. The Lithium-ion Battery-capacitor which developed by EVE is widely applied in intelligent meter (intelligent water meter/ electricity meter/gas meter/ heat meter), intelligent transportation ETC, intelligent tracking, emergency alarm eCall, field monitoring, Marine monitoring, wildlife monitoring and military.

2:55 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 state batteries. POM materials with improved electrochemical performance as the cathode materials of lithium ion batteries.

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3:25 The Commercialization of Water-Based LiFePO₄ Cathode in Li-ion Batteries for xEV and ESS Applications

Jiang Zhou, 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.

3:55 Refreshment Break in the Exhibit Hall with Poster Viewing

4:30 Recent Progress in CATL Technology

Wu Kai, Vice President, Technology, Amperex Technology, Ltd. (ATL) China

ATL is a Hong Kong based international company leading in design, manufacture, sales and marketing of rechargeable lithium ion/polymer battery cells and related battery packs and systems. In addition to the consumer electronics markets, ATL is advancing to electrical vehicles and electrical energy storage markets. This presenting will summarize the advancements and recent progress in ATL technology for rechargeable cells and pack systems.

5:00 Advanced Li-ion Cathode Materials and HNSS Contributions

Yangxing Li, Ph.D., CTO & Vice President, Hunan Shanshan (HNSS) China

Hunan Shanshan is a unique global supplier to the lithium-ion battery industry, who is currently the largest cathode producer in the world; while Shanshan group is a top material supplier for LIBs worldwide including cathode, anode and electrolyte. HNSS is well positioned to provide the desired cathode materials and is currently providing more than 60 types of cathode products to meet the needs of our customers.

KOREAN BATTERY MANUFACTURERS

5:30 Characteristics of LTO and LFP Chemistry for 12V Main Power Source and Start-Stop Vehicle (SSV) Application

Seong-Gyu Cho, Manager, Cell Development Team, EIG Ltd., Korea

Lead-acid battery has been widely used to automotive applications in spite of their low fuel efficiency and environmental problem of heavy metal. In this presentation, EIG will summarize some of the exciting challenges and results comparing with the battery performance difference of LTO and LFP chemistry in the field of 12V and 48V SSV and micro-hybrid application.

6:00 Networking Reception in the Exhibit Hall with Poster Viewing

7:00 Close of Day

WEDNESDAY, MARCH 23

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

8:50 Session Break

9:00 Plenary Keynote Session (See page 2 for details)

9:50 Coffee Break in the Exhibit Hall with Poster Viewing

EUROPEAN BATTERY MANUFACTURERS

10:35 Chairperson's Remarks

John Wozniak, Ph.D., President, Energy Storage & Power Consulting

10:40 Impact of Electrode Design Parameters on Battery Performance

Odysseas Paschos, Ph.D., Research Battery Technology, BMW, Germany and Dee Strand, Ph.D., CTO, Wildcat Discovery Technology

Electrode design parameters such as loading and porosity play a key role in the overall energy, power, and durability of an automotive cell. Models which use material/cell parameters are not adequate to predict all cell performance parameters. This presentation shows the experimental effects of cathode formulation, thickness, and porosity on key performance metrics for automotive applications.

11:00 Advances in Cell Technology for Industrial Batteries

Thomas Greszler, Chemistry Division Manager, SAFT

As Lithium Ion has matured as a technology, it has pushed into a wider range of applications. The design challenges of Lithium Ion chemistries for extreme temperature range applications, high reliability applications and extended fast rate cycle applications will be discussed.

11:20 Cell Finishing - The Underestimated Cost and Performance Factor

Raf Goosens, CEO and Co-Founder, 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. In this presentation we will discuss how to optimize cell performance with maximum safety, against a reduced manufacturing cost.

11:40 Manufacturing Technology of All-Solid-State Thin-Film Li Battery for IoT Applications

Koukou Suu, Ph.D., ULVAC Fellow, ULVAC, Inc.

Solid-state thin-film lithium secondary batteries are key to enabling technologies for standalone MEMS/Sensor devices which are essential for IoT. A detailed explanation will be given on the vacuum technologies ULVAC has developed and are required for the manufacturing of thin-film lithium secondary batteries.

11:55 Sponsored Presentation (Opportunity Available)

12:10 pm Session Break

12:20 Networking Luncheon
(All Are Welcome)

1:50 Dessert Break in the Exhibit Hall with Poster Viewing

NORTH AMERICAN BATTERY MANUFACTURERS

2:45 Chairperson's Remarks

Brian Barnett, Ph.D., Vice President, TIAX/CAMX Power

2:50 Integrated Global Design and Manufacturing

Brian Sisk, Vice President, Cell Production, A123 Systems

Here, we present A123's integrated cell design and manufacturing process – rooted in scientific mechanisms and statistical validation – used to rapidly scale-up designs from lab to pilot line to manufacturing line. This presentation will demonstrate how our integrated design process allows us to adapt to variation in requirements, materials, equipment, schedule, and conditions between manufacturing locations in order to increase productivity and reduce costs.

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3:20 Battery Materials for E-Mobility

Michael A. Fetcenko, Managing Director, BASF Battery Materials – North America
BASF offers a wide range of electrolyte and cathode materials for Lithium Ion batteries including NCA, NCM, LFP and LMO. This presentation will provide updates on product performance and commercialization for our LiB portfolio while also providing updates for our NiMH and Next Generation technologies.

3:50 Session Break with Light Refreshments

4:00 Strategies for Enhancing Performance of Cells Employing High-Nickel Cathode Materials

Suresh Sriramulu, Ph.D., CTO, CAMX Power, LLC

Successful implementation of high-nickel cathode materials in Li-ion cells is recognized to be a key approach to ensure required increases in cell energy density for a wide range of applications. In this presentation, we will highlight some of the challenges unique to high nickel cathode material implementation in Li-ion cells, and demonstrate successful strategies for overcoming these issues.

4:20 Enabling Exceptional Cycle Life and Energy Density in Silicon Based Li-ion Anode Material

Rick Constantino, Co-Founder, Group14

EnerG2 has developed a new low cost process for producing silicon based Li-ion anode materials. Our approach combines EnerG2's proven manufacturing expertise in carbon materials with state of the art silicon processing. The resulting materials have exceptional cycle life and energy density. Our presentation will share electrochemical cell data in addition to material properties.

4:40 FEATURED PRESENTATION: Re-Thinking Lithium-Ion Battery Design and Manufacturing

Naoki Ota, Ph.D., CTO, 24M

In this presentation, we will report on the development of an alternative lithium-ion cell architecture and manufacturing method developed by 24M that has a lower cost than the current lithium-ion paradigm. The new cell architecture will enable low-cost, high-energy, ultra-safe and long-life lithium-ion energy storage systems for grid, transportation and custom energy storage markets.

5:00 Session Break

5:05 Closing Plenary Keynote Session (See page 2 for details.)

5:45 Close of Main Conference

6:15 Taste of Fort Lauderdale Dine Around

Network with fellow colleagues while sampling Fort Lauderdale's fabulous local cuisine along 17th Street Causeway. Mention INTERNATIONAL BATTERY and/or show your name badge at one of the specific restaurants listed and receive a special offer. See Hotel & Travel tab of Event website for more details.



2015 Battery Innovator award winner, Victor Koch, Ph.D, President & CEO, Covalent Associates

2016 BATTERY INNOVATOR AWARD

The 33rd International Battery Seminar & Exhibit is seeking submissions for its **2nd Annual 2016 Battery Innovator Award**. The award seeks to recognize innovative advances of applied battery technology at the chemistry or product level. Judged by a team of leading industry experts, the winner will be announced on Tuesday, March 22 at 8:00am prior to the start of the conference plenary session. Winner will receive a \$2,500 cash award. Full details including entry forms are available at www.internationalbatteryseminar.com.

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TRACK 3: MARCH 21-23, 2016

BATTERY APPLICATIONS

Advanced Battery Technologies for Automotive, Consumer & Industrial Energy Applications

MONDAY, MARCH 21

7:00 am - 2:00 pm Tutorial* Registration and Morning Coffee

8:00 am - 4:00 pm Pre-Conference Tutorials*

2:30 - 6:30 Main Conference Registration

4:20 Plenary Keynote Session (See page 2 for details)

6:25 Welcome Reception in the Exhibit Hall with Poster Viewing

7:30 Close of Day

*See page 3 for Tutorial details.

TUESDAY, MARCH 22

7:00 am Registration and Morning Coffee

8:00 Plenary Keynote Session/Battery Innovator Award
(See page 2 for details)

9:40 Coffee Break in the Exhibit Hall with Poster Viewing

AUTOMOTIVE BATTERY APPLICATIONS

10:15 Organizer's Opening Remarks

Craig Wohlers, Executive Director, Conferences, Cambridge EnerTech

10:20 Chairperson's Opening Remarks

Ted Miller, Senior Manager of Energy Storage and Materials Strategy and Research, Ford Motor Company

10:25 The Need for High Energy Batteries for Traction Applications and Electrochemical Characterization of the Lithium-Silicon System

Mark Verbrugge, Ph.D., Director, Chemical and Materials Systems Laboratory, General Motors

It is clear that for battery electric vehicles and plug-in hybrid electric vehicles to gain large market share, significant improvements in battery technology are needed, particularly in terms of decreased cost and increased energy density (energy per unit volume). These needs, associated cell requirements, and advances in our understanding of the lithium silicon system are the focus of this talk.

10:55 Automotive Power Supply Challenges for Energy Storage

Matthew Denlinger, Battery Research Engineer, Energy Storage Research Department, Ford Motor Company

Demands on the traditional automotive power supply continue to increase. Newly developed technologies for vehicle functionality and improved fuel economy will require more powerful and efficient energy storage devices. This talk will outline the unique challenges facing advanced batteries in the low voltage power system.

11:25 Considerations for the Application of Advanced Electrochemical Energy Sources in the Automotive Environment

Carrie Okma, Lithium-ion Cell/Chemistry Specialist, Electrified Powertrain Propulsion Systems, Fiat Chrysler Automobiles

The automotive environment is extremely demanding on energy storage technologies. Any technology must be rigorously tested before inclusion into any production vehicle. This presentation will outline FCA US's process in selection and validating energy storage technologies.

11:55 Session Break

12:05 pm Networking Luncheon
(All Are Welcome)

1:35 Dessert Break in the Exhibit Hall with Poster Viewing

AUTOMOTIVE BATTERY APPLICATIONS (CONT.)

2:20 Chairperson's Opening Remarks

Franz Kruger, Ph.D., Head of Business Unit, Treofan Germany GmbH

2:25 Tailoring the Low Temperature Performance of Automotive Li-Ion Cells

Sandra Zugmann, Ph.D., Research Battery Technology, BMW, Germany

A critical factor for the automotive application of Li-ion cells is their temperature behavior especially at low ranges. Especially at the anode side, the solid state diffusion is lower compared to cathode which leads to lower exchange current densities. This talk will focus on discussing the challenges that need to be overcome in order to address the above mentioned issues.

2:55 Race or Marathon – Following the Development of New Battery Technology in North America

Tobias Glossman, Senior Systems Engineer, Mercedes Benz North America

Mercedes-Benz Research & Development North America is performing critical work in the global Daimler organization. This presentation will discuss the automotive perspective and will underline the difficulties in the development of next-generation batteries in academia and industry.

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3:25 High Voltage Stabilized Structures Paving the Way for High Energy Density Systems

Stephane Levasseur, Head of Business Venturing, Umicore

Current evolution is putting an overweight emphasis on very high Ni compounds. These platforms do not offer the best TCO proposal especially keeping in mind the expected Nickel price evolution and manufacturing conditions. This presentation takes a detailed look at the current Li-ion cathode development status and will give some insights on the preferred approach for a value optimized strategy when it come to pushing energy density to the next step.

3:55 Refreshment Break in the Exhibit Hall with Poster Viewing

AUTOMOTIVE BATTERY APPLICATIONS (CONT.)

4:30 Lithium Titanate Oxide (LTO) Batteries and Supercapacitors as an Option for Hybrid Vehicles

Andrew F. Burke, Ph.D., Institute of Transportation Studies, University of California, Davis

The use of lithium titanate Oxide (LTO) batteries with supercapacitors in micro (start-stop) and mild hybrid vehicles have been studied. The study involves vehicle simulations and laboratory tests of carbon/carbon supercapacitors and 6Ah and 20Ah LTO cells from EIG, Korea. The advantages of LTO batteries for the hybrid applications are evaluated from the test data.

5:00 Technology and Applications for Polypropylene Battery Separators

Franz Kruger, Ph.D., Head of Business Unit, Treofan Germany GmbH

Under the brand name Treopore, Treofan has developed a dry process for manufacturing biaxially stretched polypropylene-based films combining high mechanical and temperature stability with a nano-porous structure that can even be customized. This presentation will describe the unique Treopore separator properties and performance in large format li-ion cells for xEV and ESS markets.

5:30 What Is Next for Li-ion Applications after 20+ Years of Successful Commercialization

Joon Kim, Ph.D., CTO, Spear Power Systems, LLC

Li-ion technology has advanced significantly last 20 years since Sony introduced the first successful li-ion commercial product. And its application area has been keep expanding, yet there are number of key technical and commercial barriers need to be overcome for broader application of li-ion products. Key issues and current status of industrial efforts to overcome these will be discussed.

6:00 Networking Reception in the Exhibit Hall with Poster Viewing

7:00 Close of Day

WEDNESDAY, MARCH 23

7:45 Interactive Breakfast Breakout Discussion Groups

(See website for details)

8:50 Session Break

9:00 Plenary Keynote Session *(See page 2 for details)*

9:50 Coffee Break in the Exhibit Hall with Poster Viewing

CONSUMER ELECTRONICS BATTERY APPLICATIONS

10:35 Chairperson's Opening Remarks

Kamal Shah, Manager, Mobile Platforms, Intel

10:40 The Realities of Innovation in PC Batteries

Jeremy Carlson, Battery Technology Engineer, Lenovo

In the PC plus era it is difficult for new battery manufactures and new technologies to be brought to market first in traditional notebook PCs. Expanding complexity, increased cost, and strong requirements make it a difficult place for success. This talk will discuss the roadblocks to battery innovation in the PC space and how to increase the likelihood of success.

11:10 Battery Performance Trade-Offs in Consumer Electronics Applications

Jason Howard, Ph.D., Distinguished Member of the Technical Staff, Advanced Energy Technologies - Energy and Power Management Technology, Motorola Mobility

The continued evolution of portable consumer devices depends on the ongoing improvement and optimization of portable power sources. Battery development for consumer electronics applications must consider numerous performance parameters, including energy density, charge rate, and cycle life. This talk will discuss approaches to balancing trade-offs in these parameters, including priorities, system considerations and impact of evolving technologies.

11:40 A Case for Adaptive Charging to Prevent Li-Po Swelling

Kamal Shah, Manager, Mobile Platforms, Intel Corporation

Swelling of Lithium Polymer battery requires pack makers to make an allowance for this swelling thus reducing capacity for active material and hence battery life of the mobile devices using such battery. This presentation discusses approach to understanding how such swelling can mitigated by potentially adaptive charging.

12:10 pm Session Break

12:20 Networking Luncheon (All Are Welcome)

1:50 Dessert Break in the Exhibit Hall with Poster Viewing

INDUSTRIAL BATTERY APPLICATIONS

2:45 Chairperson's Opening Remarks

Kevin Konecky, Energy Storage Systems Consultant, Total Battery Consulting

2:50 NiMH Stationary Energy Storage - Extreme Temperature and Long Life Developments

Hirohito Teraoka, Deputy General Manager of Engineering Division, FDK Twicell Co., Ltd., Japan

Advanced NiMH batteries which can operate to -40 Centigrade have been developed through a careful analysis of cold temperature rate limiting steps and special MH anode and electrolyte design. These new NiMH batteries are especially useful in energy storage and backup power applications. This presentation will focus on product performance in these applications with emphasis on life and durability.



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3:20 Some Insights into Regulatory Challenges Facing Energy Storage System Installations

Laurie Florence, Principal Engineer, E P & C, UL LLC

Stationary battery energy storage is becoming an essential element in today's grid infrastructure for support of renewables, power quality issues and deferment of costly generation upgrades. This is a worldwide phenomenon and manufacturers of stationary battery energy storage systems are looking to install their systems in a variety of locations worldwide. What is required to install an energy storage system in the USA vs Europe for example? This presentation will try to delve into that issue from a safety validation perspective.

3:50 Session Break with Light Refreshments

4:00 Field Performance of Large Format AHI Aqueous Electrolyte Intercalation Batteries

Wei Wu, Ph.D., Principal Scientist, Aquion Energy

The performance of Aquion Energy AHI battery technology in a range of field applications will be discussed. This is a new battery chemistry that has been scaled and is installed in well over 100 locations worldwide, and we will be sharing for the first time, publically, an overview of performance.

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4:20 Significant Battery Implications Associated with 3rd Generation Thin Film Solar Technologies

J. Norman Allen, CTO, NanoFlex Power Corporation

Research institutions and private companies are readying "third generation" solar cell technology which holds the promise of mounting on roofs, building facades, and windows without adversely impacting the sight line of the building. This presentation will define 3rd generation solar, investigate its future wide spread use, and how this will likely impact the expansion of the battery business.

4:40 Air Breathing Batteries: Low Cost and High Energy Density Batteries that Will Create New Markets for Consumer and eV Applications

Philippe Stevens, Ph.D., Senior Scientist, R&D, Electricité de France (EDF)

Aqueous based metal air batteries have the potential for very low cost but also high energy density. Two different metal-air batteries are being developed at EDF, both of which are game changers in the field of storage. Cost and safety are the primary concerns for consumer applications such as residential storage, for which zinc-air batteries can be the answer.

5:00 Session Break

5:05 Closing Plenary Keynote Session (See page 2 for details.)

5:45 Close of Main Conference

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SYMPOSIUM 1: MARCH 24, 2016

BATTERY SAFETY

Innovations to Improve Lithium Battery Safety from Cell to Systems

THURSDAY, MARCH 24

7:30 am Symposium* Registration and Morning Coffee

CELL SAFETY, PERFORMANCE AND LIFETIME MANAGEMENT

8:00 Organizer's Opening Remarks

Mary Ann Brown, Executive Director, Conferences, Cambridge EnerTech

8:05 Chairperson's Opening Remarks

Judith Jeevarajan, Ph.D., Research Director, Electrochemical Safety, Underwriters Laboratories, Inc.

» 8:10 FEATURED PRESENTATION: LI-ION BATTERY SAFETY TECHNOLOGIES AND THEIR IMPLEMENTATION

Brian Barnett, Ph.D., Vice President, TIAX/CAMX Power

Under suitable triggers/abuses, Li-ion cells can experience thermal runaway, i.e., a rapid increase in cell temperature accompanied by venting, vent-with-flame, ejection of cell parts, fire and explosion. Our investigations of these types of triggers reveals very different underlying physics and mechanisms, requiring very different approaches to prevent safety incidents due to each cause. This presentation highlights specific means to enhance safety with respect to each trigger.

8:40 All Tests and Standards Are Not Created Equal – Even if They Have the Same Name!

Cindy Millsaps, President & CEO, Energy Assurance LLC

We are constantly asked what are the overlaps between the tests in various standards? Do we really have to re-test separate batteries for Overcharge and Short Circuit across standards? Can't we reuse data? Unfortunately, in the world of non-harmonized standards, this doesn't work. We provide an in-depth look at the differences between commonly named tests across test standards for small format batteries used in portable devices.

9:10 Enhanced Battery Safety by Applying Embedded Photonic Sensors

Antonio Nedjalkov, Dipl.-Ing., Research Associate, Department for Fiber Optical Sensor Systems, Heinrich Hertz Institute, Fraunhofer-Gesellschaft

In this presentation, the application of fiber optical sensors for enhanced battery safety is presented. Simultaneously monitoring temperature and volume expansion of the battery cell allows accurate estimation of SOH and SOC. Failure and malfunction such as overcharging, gassing and thermal runaway can also be predicted by such a monitoring system as well as battery aging effects.

9:40 Coffee Break with Poster Viewing

10:10 Safe Lithium-Ion Battery Designs for Use, Transportation and Second Use

Judith Jeevarajan, Ph.D., Research Director, Electrochemical Safety, Underwriters Laboratories, Inc.

The presentation includes recommended safe designs for high-voltage, high-capacity battery designs that are becoming more common in use today. The presentation also includes recommendations on determining health of lithium-ion battery modules before second-life usage.

10:40 Single-Point Probes for Lithium-Ion Battery Fault Detection and Temperature Monitoring

Corey T. Love, Ph.D., Materials Research Engineer, Alternative Energy Section, Chemistry Division, U.S. Naval Research Laboratory

State-of-health (SOH) of lithium-ion batteries (LIBs) is a measure of the stability of the internal chemistry, electrochemistry and mechanical components. We present an impedance-based strategy which improves LIB safety two-fold: (1) as a single-point probe of LIB SOH for internal fault detection to mitigate a full failure event and (2) as an online monitor of internal temperature to warn of rapid cell heating prior to thermal runaway.

11:10 Addressing the Safety Issues Related to Air Transportation of Lithium-Ion Batteries with Effective Engineered Thermal Management Solutions

Richard Clark, Strategic Business Development Specialist, Morgan Advanced Materials

The demand for high energy density lithium-ion batteries is increasing dramatically with the growth of applications such as electric vehicles, grid storage, electric bikes and uninterrupted power systems. With the majority of manufacturing distant from the point of use, air is and will continue to be a major and in some cases only practical means to transport the batteries. It is of fundamental importance to the industry that effective solutions be implemented to protect the aircraft, crew and passengers from the consequences of catastrophic thermal events. Morgan Advanced Materials as a global leader in fire protection systems is developing effective solutions to address these challenges. This presentation will provide details of the current legislation and information about how Morgan is helping the lithium-ion battery and air transportation industries in this critically important domain.

11:40 Enjoy Lunch on Your Own

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MODELING AND ENGINEERING A SAFE SYSTEM FOR VARIOUS APPLICATIONS

1:20 pm Chairperson's Remarks

Brian Barnett, Ph.D., Vice President, TIAX/CAMX Power

1:25 NREL Multiphysics Modeling Tools for Designing Safer Li-Ion Batteries

Ahmad A. Pesaran, Ph.D., Manager, Energy Storage Group, Transportation and Hydrogen System Center, National Renewable Energy Laboratory (NREL)

The National Renewable Energy Laboratory has developed a portfolio of multiphysics modeling tools to aid battery designers to better understand the response of lithium-ion batteries to abusive conditions. We discuss this portfolio, which includes coupled electrical, thermal, chemical, electrochemical and mechanical modeling. These models can simulate the response of a cell to overheating, overcharge, mechanical deformation, nail penetration and internal short circuit. Cell-to-cell thermal propagation modeling will be discussed.

1:55 Li-Ion Battery Characterization across Space and Time: Imaging Microstructure in 2D, 3D and 4D

Jeff Gelb, Senior Applications Development Engineer, Carl Zeiss X-ray Microscopy

For modern battery researchers, image-based studies can be very beneficial. Here, we present the latest results in using light-, electron-, and X-ray microscopy to characterize a commercial 18650 battery cell across multiple length scales. We will show some recent work in characterizing defect nucleation and propagation as a function of charge cycling, revealing the microstructure associated with various cycling rates and corresponding capacity fades.

2:25 Effects of Cell Reversal on Li-Ion Batteries

E. Joseph Nemanick, Ph.D., Senior Member, Technical Staff, Energy Technology Department, The Aerospace Corporation

Selected Li-ion cells were purposely put into a reversal condition to determine the effect on the cells' operating temperature, electrical characteristics, capacity and cyclability. Destructive physical analysis (DPA) of reversed cells will also be presented.

2:55 Refreshment Break with Poster Viewing

3:30 Experiments and Simulations for Battery Safety

Sergiy Kalnaus, Ph.D., Research Scientist, Computational Engineering and Energy Sciences, Oak Ridge National Laboratory (ORNL)

The results from the integrated computational and experimental program targeting investigation of safety of Li-ion batteries will be presented. Novel manufacturing approaches towards improvement of safety under external impact will be discussed. Computational modeling was performed with ORNL developed Virtual Integrated Battery Environment (VIBE), which allows coupling between different physics characteristic of battery operation (electrochemistry, thermal transport, mechanics). Predictive capabilities as well as validation studies will be shown.

4:00 From Safe Batteries to Safe Systems

Todd Vanyo, Senior Systems Engineer, Texas Instruments

Making a safe system requires more than just a safer battery. From improved measurement accuracy to active cell balancing, this talk highlights a number of techniques that can be implemented in the system to ensure that overall safety goals are reached.

4:30 Mesoscale Implications in Lithium-Ion Battery Thermal Behavior

Chien-Fan Chen, Energy Storage Lead, Energy and Transport Sciences Laboratory, Mechanical Engineering, Texas A&M University

A critical imperative in recent years has been on accelerating innovation toward improved safety, performance and life of the lithium-ion battery (LIB), a leading candidate for electric drive vehicles. LIB electrodes include coupled physicochemical processes encompassing electronic/ionic/diffusive transport, electrochemical reaction, heat generation and diffusion induced stress. This talk seeks to define the mesoscale implications of the underlying physicochemical interactions on the lithium-ion battery thermal behavior and safety.

5:00 Close of Symposium & Close of International Battery Seminar & Exhibit

As the longest-running annual battery industry event in the world, this meeting has always been the preferred venue to announce significant new developments and to showcase the most advanced battery technology.

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CO-LOCATED EVENT SYMPOSIUM 2: MARCH 24, 2016

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FUEL CELLS

Next Generation Fuel Cells for Commercial, Military & Industrial Applications

THURSDAY, MARCH 24

7:30 am Symposium* Registration and Morning Coffee

8:00 Organizer's Opening Remarks

Craig Wohlers, Executive Director, Conferences, Cambridge EnerTech

8:05 Chairperson's Opening Remarks

Allison Fisher, Ph.D., Visiting Professor, University of Central Florida

» 8:10 FEATURED PRESENTATION: FUEL CELL AND HYDROGEN ENERGY - THE FUTURE IS NOW

Morry Markowitz, President, Fuel Cell & Hydrogen Energy Association

An overview of the growing impact the fuel cell and hydrogen industry is making on the stationary power, transportation, material handling and other major industry sectors.

FUEL CELLS MATERIALS, DESIGN & MODELING

8:40 Novel Anion Exchange Membranes for Hydrogen and Hydrazine Alkaline Fuel Cells

Kenji Miyatake, Ph.D., Professor, Clean Energy Research Center, University of Yamaguchi, Japan

Molecular design, synthesis, and characterization of novel anion exchange membranes composed of perfluoroalkyl chains and phenylene rings with ammonium groups will be reported. The membranes exhibit high hydroxide ion conductivity and function well in alkaline fuel cells.

9:10 Advances in MEA Development: Automotive Application, Low PGM, Durability, Materials by Design Approach

Madeleine Odgaard, CEO, IRD Fuel Cells, LLC, Denmark

The prime focus of the work presented is development of high-performing MEAs aimed for automotive applications through materials R&D and process optimization. The aim is to fulfill OEM requirements with respect to cost, performance and durability. Development of low-PGM-loading electrodes with catalysts based on stable support materials is addressed in the work.

9:40 Coffee Break with Poster Viewing

10:10 High Energy Density Solutions for Energy Generation, Hydrogen Generation, and Energy Storage

Chris D'Couto, Ph.D., President and CEO, Neah Power

Neah will discuss the porous silicon architecture that it uses for its non-air fuel cell and how it is leveraging that to create a manufacturable, high energy density lithium battery. Neah will also discuss the recently released Formic acid reformer technology that has demonstrated one of the highest energy

density for hydrogen generation from a safe, liquid source.

ADVANCED FUELS AND INNOVATIVE APPROACHES

10:40 An Appreciation of Solid Hydrogen Storage and Release

Allison Fisher, Ph.D., Visiting Professor, University of Central Florida

An overview of solid hydrogen fuel cartridges will be presented with emphasis on the areas where chemistry plays a significant role. The journey will begin with the fuel and focus on active R&D efforts to understand and optimize solid hydrogen material properties for safe storage and dehydrogenation when fuel is needed. A non-proprietary description of current and future solutions for these balance of plant components will also be presented.

11:10 Sponsored Presentation (Opportunity Available)

11:40 Enjoy Lunch on Your Own

ADVANCED FUEL CELLS FOR TRANSPORTATION APPLICATIONS

1:20 pm Chairperson's Remarks

Andrew Burke, Ph.D., Institute of Transportation Studies, University of California, Davis

1:25 Development of Heavy Duty Fuel Cell Modules for Mass Transport Applications

Mauricio Blanco, Ph.D., Research Engineer, Strategic Technology Planner, Ballard Power Systems

Ballard has seen an increase in market demand and customer engagement for fuel cell buses in China, the USA and Europe. Ballard's high performance FCvelocity®-HD modules have demonstrated exceptional reliability while clocking millions of kilometers on the road, principally in bus fleets. This talk will describe Ballard's development and collaborative research activities to support the durability of heavy duty fuel cell systems.

1:55 Natural Gas as a Bridge to Hydrogen Fuel Cell Light-Duty Vehicles

Andrew Burke, Ph.D., Institute of Transportation Studies, University of California, Davis

In this paper, detailed comparisons are made between various types of light-duty vehicles fueled with natural gas and hydrogen. Detailed computer simulations of the vehicles are presented for several driving cycles and the energy (MJ) and volume (L) of fuel required to meet the 400 mile range target for each vehicle using natural gas and hydrogen are compared.

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2:25 Fuel Cells for Unmanned Systems Propulsion

James C. Sisco, Ph.D., Principal Engineer, Protonex Technology Corporation

Protonex has worked extensively in the development of high performance power systems based on its groundbreaking fuel cell technology for a variety of unmanned platforms including numerous demonstrations for UAV, UGV and UUV systems. This presentation will highlight the advances that Protonex has made in its fuel cell based power systems for unmanned systems.

2:55 Refreshment Break with Poster Viewing

3:30 Methanol Vapor Fuel Cell for Optimum Light Weight Power

Walt Robb, Ph.D., CEO, MeOH Power

When light weight is desired, a fuel cell that needs only 0.8 gram per watt hour, and uses a very safe fuel, is very hard to beat. Reducing the weight of the fuel cell is important, and not requiring a pumped loop for Carbon Dioxide extraction is huge advantage.

4:00 Fuel Cell and Battery Hybrid for Energy Storage - Battery for Rapid Response and Fuel Cells for Range Extension for Storage

Pinakin Patel, Director, Research & Special Systems, FuelCell Energy, Inc.

The high efficiency and fuel flexibility of SOFC technology also makes it attractive for select portable power applications. This presentation will focus on advances in hybrid battery and fuel cells for energy storage.

4:30 Fuel Cells for Industrial Vehicles

Gus Block, Director, Nuvera Fuel Cells

In December 2014, Nuvera Fuel Cells, Inc., manufacturer of fuel cell systems and hydrogen generation and refueling equipment, was acquired by the operating company of Hyster-Yale Materials Handling, Inc. (NYSE: HY). Hyster-Yale Materials Handling, a leading lift truck manufacturer, has begun rapid development of Nuvera's fuel cell technology across large parts of the Hyster® and Yale® product lines. This presentation will describe Hyster-Yale and Nuvera's progress in the commercialization of motive power products for industrial trucks.

5:00 Close of Symposium & Close of International Battery Seminar & Exhibit

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For additional information, contact:

Sherry Johnson | Business Development Manager
250 First Avenue, Suite 300 | Needham, MA 02494
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| Three Tutorials | \$899 | \$649 |
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| Main Seminar Only Late Rate Registration After February 19 | \$1,699 | \$1,159 |
| Symposium Advance Registration Rate Until February 19 | \$949 | \$679 |
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PROGRAM SELECTIONS

Tutorials: March 21

TUT1: The Rechargeable Battery Market
TUT2: Materials Selection and Design for Batteries with High Energy Density, Ultralong Cycle Life and Excellent Safety
TUT3: Battery Safety Training
TUT4: EV Battery Recycling Technology
TUT5: Recent Advances in Solid State Electrolytes for Energy Storage
TUT6: Technoeconomic Analysis of Battery Material Development and Manufacture
TUT7: Batteries for Medical Devices

Main Seminar Tracks: March 21-23

T1: BATTERY R&D

T2: BATTERY MANUFACTURING

T3: BATTERY APPLICATIONS

Symposia: March 24

S1: BATTERY SAFETY

S2: FUEL CELLS

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 19, 2016**.

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

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