9TH INTERNATIONAL

aabc europe

advanced automotive battery conference

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THE FUTURE WILL BE DRIVEN BY VEHICLE ELECTRIFICATION

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2019 CONFERENCE PROGRAMS

- R&D Symposium 1 **CHEMISTRY**
- R&D Symposium 2 **RAW MATERIALS**
- Application Conference 1 **HYBRID & ELECTRIC VEHICLES**
- R&D Symposium 3 **ENGINEERING**
- R&D Symposium 4 **LEAD-BASED**
- Application Conference 2 **SPECIALTY TRANSPORT EVs**

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Welcome!

Dear Colleague,

I am pleased to share with you the excitement about AABC Europe 2019, and to invite you to join us in Strasbourg, France, this coming January. Three major events have greatly intensified EV battery development efforts over the last 2-3 years: i) the market success of Tesla, ii) the rapid growth of the Chinese EV market, and iii) the diesel scandal. The latter has brought about a sharp drop in tolerance on the part of both governments and consumers for a diesel fuel that turns out to be less than clean, and it is driving the push for an alternative powertrain, while the first two events have caused a change in the carmakers' assessment of the marketability of electrified vehicles.

As a result, European carmakers are expanding their xEV development efforts while pulling in and increasing the volumes of production plans. This chain of events has created significant opportunities for the xEV supply chain, but with those come notable risks. The carmakers' expectations for lower pricing, longer driving range, and fast charge capability are all demanding and, of course, durability and safety cannot be sacrificed.

We at AABC understand the opportunities and challenges and have created a program that will help you follow the trends, the issues, and the directions adopted by key players. In addition to our renowned xEV battery sessions—which cover the xEV and xEV-battery markets, batteries for low- and high-voltage hybrids and full electric vehicles, and battery durability in automotive applications—the program will also feature sessions on:

1. Li-ion battery materials and chemistry
2. Li metal battery chemistry
3. Raw material supply and recycling
4. Lead-acid battery technology and application advances
5. Charging technology and infrastructure
6. Battery safety and cell and battery engineering
7. Batteries for specialty, light, off-road vehicles, and public transportation

This is a pivotal time for the industry, with second-generation products hitting the market, and roadmaps for third-generation products being drawn—with expectations for considerable volume expansion. Join us in Strasbourg to start 2019 well-informed!

Sincerely,
Menahem Anderman
Conference Chair

Top Reasons to Attend

- Learn first-hand about the technical and business directions from major automakers currently active in the European market
- Hear key global market outlook data on the forecasted consumption trends for China, Japan, Korea, Europe and the United States
- Meet leading energy storage technologists from all automakers active in the European market
- Discuss fast-charging solutions coming to the market to support 2035 goals of electrification
- Get an in-depth international overview of the lead industry including current trends, competitive analysis and examination of the key players and their strategies for market growth
- Discover the latest technological advancements in high specific energy batteries with long cycle life and low cost.
- See how key players are overcoming challenges to commercialization for the speciality EV battery market while assessing consumer demand and competing technologies
- Understand the many facets of the international battery raw materials market, including advances in mining and processing with an emphasis on sourcing and cost control strategies by manufacturers
- Network at the largest international gathering of advanced energy storage technology developers and integrators in Europe

Conference at-a-Glance

Sunday 27 January	Monday–Tuesday 28 January -29 January	Wednesday–Thursday 30 January - 31 January
INTERACTIVE TUTORIALS	**R&D SYMPOSIA**	**APPLICATION CONFERENCES**
Tutorials: See page 5	R&D Symposium 1 CHEMISTRY	Application Conference 1 HYBRID & ELECTRIC VEHICLES
	R&D Symposium 2 RAW MATERIALS	
	R&D Symposium 3 ENGINEERING	Application Conference 2 SPECIALTY/PUBLIC TRANSPORT EVs
	R&D Symposium 4 LEAD-BASED	
	Dinner Tutorials See Page 5	

AABC Europe 2018 by the numbers

Every level of the supply chain represented

32 OEMs

70 TIER ONE Pack Integrators & Cell Manufacturers

60 TIER TWO Battery Component Providers

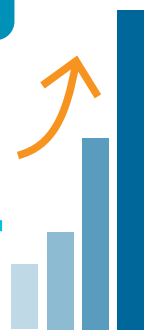
72 TIER THREE Battery Materials Developers

26 TIER FOUR Raw Material Suppliers

Largest AABC Event Ever

39% growth in attendance over last year

112% GROWTH IN ATTENDANCE since 2015



96% Stated the Event Met or Exceeded Expectations

89% Will Attend Again

48 UNIVERSITIES

31 RESEARCH INSTITUTIONS

Attendees told us what makes AABC so valuable

Technical Sessions · Access to OEMs · **Networking** · Supply Chain Represented · Exhibit Hall · **Market Overview/Trends** · Tutorials & Training · **PROGRAM QUALITY**

32 TESTING & SIMULATION Companies

15 MANUFACTURING EQUIPMENT VENDORS

10 CHARGING PROVIDERS

9 Recycling Companies

1,000 HIGH-LEVEL DELEGATES

54% Decision Makers

62 SPONSORS, EXHIBITORS & PARTNERS

159 TECHNICAL PRESENTATIONS

79 SCIENTIFIC POSTERS

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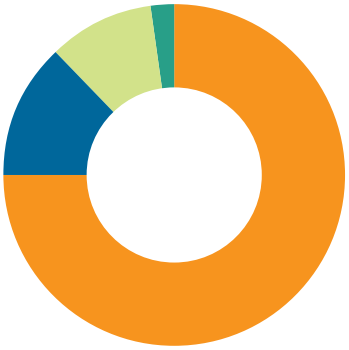
EXHIBIT

Exhibitors will enjoy facilitated networking opportunities with all conference delegates, making it the perfect opportunity to launch a new product, collect feedback, and generate new leads from around the globe.

Geographic Location



- Europe **75%**

European Breakdown
- Germany **59%**
- Rest of Europe **10%**
- United Kingdom **9%**
- France **7%**
- Belgium **6%**
- Switzerland **3%**
- Austria **3%**

- United States **13%**
- Asia **10%**
- Rest of World **2%**

Delegate Title

- Manager **28%**
- Executive Director **26%**
- Scientist/Technologist **20%**
- Sales & Marketing **16%**
- Professor **4%**
- Other **6%**

FOR ADDITIONAL INFORMATION REGARDING SPONSORSHIP AND EXHIBIT OPPORTUNITIES, PLEASE CONTACT:

Sherry Johnson
Manager, Business Development
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TUTORIALS*

27 & 28 January 2019

SUNDAY, 27 JANUARY

Afternoon Tutorial | 15:00 - 17:00

TUT1: The Rechargeable Battery Market: Value Chain and Main Trends 2018-2028

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 2018-2028 will be discussed.

Christophe Pillot, PhD, Battery Survey Manager, Avicenne Energy, France

Concurrent Dinner Tutorials | 18:00 - 20:00

TUT2: Battery Pack Engineering for xEVs

This tutorial will give an overview of battery systems design. An overall product development process will be discussed for a typical system. Design aspects of each individual subsystem will be explored with cost impacts of different design choices. Testing, validation and designing for safety will be other key areas of discussion.

Kevin Konecky, Energy Storage Systems Consultant, Total Battery Consulting

TUT3: Managing and Understanding the Risks of Li-Ion Battery Safety

A wide variety of stresses and abuses of Li-ion cells can result in safety events involving significant, even violent energy release and thermal runaway. This tutorial provides a framework for a better understanding of how these events occur, how lithium-ion batteries respond to various stresses/abuses, how various stresses can lead to thermal runaway and why these stresses produce challenges to assessment of safety characteristics of Li-ion cells. For major types of stress/abuse, a flow chart identifying key process steps and characteristics of cell response helps provide important insights regarding similarities and differences of various types of safety-related failures. A systematic understanding of similarities and differences of most types of stresses helps provide perspective regarding management of Li-ion battery safety as well as appropriate safety testing.

Brian Barnett, PhD, President, Battery Perspectives LLC

** Separate registration required*

MONDAY, 28 JANUARY

Concurrent Dinner Tutorials | 18:30 - 20:30

TUT4: Battery Safety and Abuse Tolerance Validation

Batteries have become daily use components for many applications. New growing segments like EV and Grid storage batteries extend the traditional ordinary battery applications. In the race for energy density, we shouldn't forget the safety - as an example, the Samsung Galaxy Note 7 battery safety case. Unfortunately, we face daily safety events with injuries and severe damage. This workshop focuses on portable, stationary and automotive battery safety along the 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 26 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.

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

TUT5: Lithium-Ion Cell Design

This tutorial covers lithium-ion cell design with a focus on xEVs. The major topics discussed are 1) How the choice of active material affects electrode design including new materials like silicon, 2) The critical role of electrolyte formulations, 3) Cell design for safety, and 4) Optimizing cell design for cost and performance.

Bob Spotnitz, PhD, President, Battery Design LLC

TUT6: Materials for Next Generation Batteries

This tutorial will cover the materials and performance challenges for next generation batteries for electric vehicles, the electricity grid and electric flight. The needs and use cases for storage in these three applications will be analyzed. The possibilities for advanced lithium-ion batteries with lithium metal anodes and solid-state electrolytes, for beyond lithium-ion batteries including lithium-sulfur and lithium-oxygen conversion cathodes and multivalent intercalation batteries with magnesium, calcium and zinc anodes for vehicles will be presented. Redox-active polymer ("redoxmer") batteries for the electricity grid will be discussed. Lithium and magnesium anodes, wide electrochemical window electrolytes and high voltage cathodes will receive special attention. New discovery approaches based on materials simulation and statistical learning will be discussed.

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

TUT7: Solid-State Batteries – Solid Electrolytes, Electrode Interfaces and Full Cells

This tutorial will give an overview on the status of solid-state battery development. The scientific basis for solid-state batteries will be explained in detail. The different types of solid electrolytes (oxides, sulfides, polymers) will be introduced, and recent trends will be highlighted.

Jürgen Janek, PhD, Professor, Director, Center of Materials Research, Justus-Liebig University & BELLA, Institute of Nanotechnology, Karlsruhe Institute of Technology, Germany

TUESDAY, 29 JANUARY

Dinner Tutorial | 18:30 - 20:30

TUT8: Lithium-Ion Battery Raw Materials Markets

This tutorial will present 10-year forecasts from Roskill on: Automotive, ESS, power & motive and portable electronics demand for advanced batteries; trends in active materials (cathode, anode, electrolyte); outlook for supply, demand and prices of key battery raw materials (lithium, nickel, cobalt, manganese, graphite +/- alumina, fluorochemicals, copper and aluminium); supply chain developments, corporate linkages and investment; and, emerging/future technology shifts and material requirement changes.

Robert Baylis, Managing Director & Principal Consultant, Battery Raw Materials, Roskill Information Services

Jose Lazuen, Senior Analyst, EV, Battery & Supply Chain, Roskill Information Services

Nessa Zhang, Senior Analyst, Cathode and Raw Materials, Roskill Information Services

LITHIUM BATTERY CHEMISTRY SYMPOSIUM

Advancements in Lithium-Ion and Beyond

MONDAY, 28 JANUARY

8:00 Symposium Registration and Morning Coffee

LITHIUM-ION BATTERIES

9:30 Chairperson's Opening Remarks

Martin Winter, PhD, Chair, Applied Material Science for Energy Conversion and Storage, MEET Battery, Research Center, Institute of Physical Chemistry, University of Muenster

9:35 FEATURED PRESENTATION: From Li-Ion to Na-Ion : What to Expect?

Jean-Marie Tarascon, PhD, Professor of Chemistry, Collège de France & Director, French Research Network, Electrochemical Energy Storage (RS2E)

The development of improved rechargeable batteries represents a major technological challenge for this new century, as batteries constitute the limiting components in the shift from gasoline powered to electric vehicles, while also enabling the use of more renewable energy on the grid. To minimize the ecological implications associated with their wider use, we must integrate sustainability of battery components into our research endeavors. The challenges to developing batteries with minimal ecological footprints are enormous. Within this context, departing from Li-ion, our new findings with the sodium ion chemistry which uses novel materials/electrolyte design together with the assembly of 18,650 prototypes will be presented.

10:15 Market Update on Materials Development for High Energy Density Automotive Batteries

Stephane Levasseur, PhD, Senior Director Technology Strategy, Rechargeable Battery Materials, UMICORE

Long EV range, fast charge, low cost, sustainability, safety … the requirements for automotive batteries constantly push materials and cell makers to propose optimized solutions. This presentation takes a detailed look into a range of high energy active materials, their advantages and drawbacks, and gives an overview of the potential choices for the chemistry combinations that will enter the market in the next years.

10:35 Networking Coffee Break with Poster Viewing

11:05 Universally Applicable Cobalt Grain Boundary Enrichment - Effective Pathway for Low-Cobalt, High-Performance Cathode Materials

Suresh Sriramulu, PhD, CTO, CAMX Power

Achieving high performance while reducing the Cobalt content of the cathode is a major challenge facing Li-ion batteries today. We have developed a new class of high-Ni cathode materials - GEMX – which are polycrystalline materials with grain boundaries enriched with Cobalt. In this presentation, we will highlight the many advantages of enriching the grain boundaries with Cobalt for high-nickel cathodes including high capacity and excellent cycle life while minimizing Cobalt.

11:25 Talk Title to be Announced

Hartman Leube, PhD, Senior Vice President, RCN, New Technologies, BASF

11:45 Oxyfluoride Based Cathode Materials with Disordered Rock Salt Structure

Robert Dominko, PhD, Laboratory Head, Director, National Institute of Chemistry

Oxyfluoride materials with a disordered rock salt structure represent a new class of high energy density cathodes for Li-ion batteries. Lithium diffusion is facilitated with disorder and presence of defects in the structure. Moreover oxyfluorides have at least doubled theoretical capacity compared to some cathode materials which are currently used in the commercial batteries. Synthesis, structural properties and electrochemical storage mechanism will be discussed in this presentation.

12:05 Recent Developments on High Voltage LNMO Spinel

Sponsored by HALDOR TOPSOE

Jonathan Højberg, PhD, Principal Scientist, Advanced Materials, Haldor Topsoe A/S

This talk presents the LiNi0.5Mn1.5O4 high voltage spinel material TBM-129 developed by Haldor Topsoe A/S to have good powder properties, high tap density and low degradation. Batteries based on LNMO have high energy density and are significantly cheaper compared to cells with high-nickel tri-metal cathode materials like NCA and NMC811.

12:30 Networking Lunch

13:55 Chairperson's Remarks

Martin Winter, PhD, Chair, Applied Material Science for Energy Conversion and Storage, MEET Battery, Research Center, Institute of Physical Chemistry, University of Muenster

14:00 Title to be Announced

Jürgen Janek, PhD, Professor, Director, Center of Materials Research, Justus-Liebig University & BELLA, Institute of Nanotechnology, Karlsruhe Institute of Technology

14:20 New Approaches to Cathode Manufacturing to Meet Emerging Environmental Restrictions

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Stu Hellring, PhD, Associate Fellow, Mobility, PPG Industries

NMP faces mounting global regulatory pressure, and recently issued EU directives could effectively eliminate NMP usage by 2021. Novel solutions are needed to manufacture cathodes without NMP. PPG is actively engaged in developing innovative solutions that address eco-friendly battery manufacturing as well as providing other performance improvements in energy storage.

14:40 Q&A

15:15 Refreshment Break with Poster Viewing

LITHIUM METAL CHEMISTRIES

15:50 Chairperson's Remarks

Jürgen Janek, PhD, Professor, Director, Center of Materials Research, Justus-Liebig University & BELLA, Institute of Nanotechnology, Karlsruhe Institute of Technology

15:55 Lithium-Ion Metal

Ulrich Wietelmann, PhD, Manager, Research and Development, Albemarle

16:15 Engineering Lithium Metal to Enable Long-Term Cycling with Carbonate-Based Electrolytes

Dee Strand, PhD, CSO, Chemistry, Wildcat Discovery Technologies

Wildcat Discovery Technologies has developed both *in situ* and *ex situ* surface passivation methods for lithium metal to significantly boost the cycling performance of lithium metal batteries. We will show investigation of passivation materials in combination with a variety of electrolyte compositions. As a result, we demonstrate several protection layers for the lithium anode surface that show significant improvements in cycling, even at 0.9 mA/cm2 charging current.

16:35 From Liquid to Solid: High Conductivity Electrolytes for Lithium Batteries

Andreas Hintennach, PhD, Professor, Research HV Battery Systems, Daimler AG

Novel and sustainable electroactive materials can help to decrease the ecological impact of novel battery concepts soon. While on the one hand, high energy density is required, the aspects of safety, lifetime get more important and often mean a challenge. All these requirements are met by very different approaches with different characteristics: all solid-state cells, high-energy materials, lithium-sulfur and even different systems, e.g. Na- or Mg-Ion.

16:55 Q&A

17:10 Welcome Reception with Poster Viewing

18:15 Dinner Tutorial Check-In*

20:30 Close of Day

** Separate registration required, please see page 5 for details*

TUESDAY, 29 JANUARY

7:30 Symposium Registration and Morning Coffee

SOLID ELECTROLYTE BATTERIES

8:30 Chairperson's Opening Remarks
Martin Winter, PhD, Chair, Applied Material Science for Energy Conversion and Storage, MEET Battery, Research Center, Institute of Physical Chemistry, University of Muenster

8:35 Solid State Battery Development
Ryoji Kanno, PhD, Professor, Institute of Innovative Research, Tokyo Institute of Technology

9:15 Toward Room-Temperature Lithium Metal Batteries
Margaud Lécuyer, PhD, Electrochemistry Engineer, Innovation and Production Monitoring, Blue Solutions

BlueSolutions commercializes lithium metal polymer batteries and implements its packs in electric vehicles and in stationary applications. Today, one of the main drawback of this technology remains its high operating temperature. During this talk, impacts of salt and solvent choice on low temperature cyclability and lithium deposits density will be depicted. It will also be highlighted how these formulations have been converted into a gelified full lithium metal battery.

9:35 Solid State Polymer with Room Temperature Conductivity—Higher Performing Solution
Mike Zimmerman, Founder, Ionic Materials

In this session, attendees will learn about a new polymer material that enables safe solid-state batteries that are operational at room temperature and compatible with a handful of widely desired, next-generation battery chemistries, including safe lithium ion, lithium metal, rechargeable alkaline and more. The presentation will provide inside access to data and use cases for polymer electrolyte battery solutions.

9:55 Glass Ceramics as Solid Electrolytes. A Chance for An Industrial Solution
Andreas Roters, PhD, Senior Project Manager New Venture, Research and Development, SCHOTT AG

Solid state batteries gain increasing interest to overcome limitations of existing Lithium ion batteries in safety and energy density. As solid electrolytes, oxidic ceramic electrolytes like LLZO and LATP are well established and analyzed, but a promising solution for a high energy SSB is still missing. Glass ceramic materials offer the chance for a broader material variety, since the glassy phase gives an additional degree of freedom to design the material to the needs of an SSB. The long experience in the industrial production concepts for high precision and high-performance glass ceramics, also for high volume markets, leads the way for the industrialization of glass ceramic solid electrolytes.

10:10 Grand Opening Coffee Break with Exhibit & Poster Viewing

Sponsored by AVL

SOLID ELECTROLYTE BATTERIES

11:00 Chairperson's Remarks
Martin Winter, PhD, Chair, Applied Material Science for Energy Conversion and Storage, MEET Battery, Research Center, Institute of Physical Chemistry, University of Muenster

11:05 Oxide-Based All-Solid-State Li-Batteries - Current Challenges in Fabrication and Operation
Martin Finsterbusch, PhD, Group Leader, Manager, Solid State Batteries, Forschungszentrum Jülich

All-Solid-State Li-Batteries (Li-ASBs) promise to alleviate many issues related to the use of organic liquid electrolytes in conventional Li-ion batteries since they have the potential to simultaneously increase the energy and power density while offering intrinsic safety and low degradation. However, when scaling up to larger cells sizes, several challenges are currently faced during fabrication and operation when using oxide based ceramic electrolytes and Li metal as anode.

11:25 Bulk All Solid-State Batteries: Recent Developments Towards High Cell Energy and Production Scale-Up
Doug Campbell, CEO, Solid Power, Inc.

All solid-state batteries have emerged as having the highest potential for displacing convention Li-ion batteries. Achieving their high energy potential, however, requires several developments around high capacity anodes, cathodes and solid electrolyte improvements. Further, these developments must be compatible with highly scalable manufacturing processes enabling large format and high-quality cells for use in future electric vehicles. This talk will cover Solid Power's recent R&D and production scale-up developments as well as the Company's near- to mid-term development plan towards commercialization.

11:45 Solvay´s Last Developments on Electrolyte Ingredients for HV Li-Ion Batteries

Sponsored by SOLVAY

Thomas Mathivet, Business Development Manager, Battery Europe, Solvay

A leading target of the Li-Ion battery industry is to achieve high energy density at affordable cost without compromising on safety. Solvay has increased its efforts to propose innovative electrolyte ingredients to battery makers, enabling high voltage solutions.New results with fluorinated additives and Energain® on silicon graphite/lithium anodes will be presented.

12:05 Q&A

12:40 Networking Lunch

13:55 Dessert Break with Exhibit & Poster Viewing

ADVANCED LITHIUM ION

14:40 Chairperson's Remarks
Dee Strand, PhD, CSO, Chemistry, Wildcat Discovery Technologies

14:45 Talk Title to be Announced
Patrick Bernard, PhD, Director, Research, SAFT

15:05 Advanced Battery Materials from Unit Operations
Mark Obrovac, PhD, Professor of Chemistry and Physics, Chemistry, Dalhousie University

15:25 Talk Title to be Announced
Benjamin Park, PhD, Founder & CTO, Research & Engineering, Enevate Corporation

15:45 Addressing the Key Challenges of Li-Ion Batteries for Electric Vehicles Thanks to Arkema's Materials
Grégory Schmidt, PhD, Research & Development Scientist Li-Ion Battery, Arkema

The current development of EV LIB requires an improvement of energy density at affordable cost without compromising on safety. Arkema is developing innovative electrolytes enabling high voltage and long life solutions, binders for electrode and separator coating to increase capacity and safety, conductive additive to increase power performance and lifetime.

16:05 Q&A

16:25 Networking Reception with Exhibit & Poster Viewing
(Sponsorship Opportunity Available)

17:25 Dinner Tutorial Check-In*

20:30 Close of Day

** Separate registration required, please see page 5 for details*

GLOBAL BATTERY RAW MATERIALS SYMPOSIUM

Balancing Supply, Demand & Costs for Battery Component Materials

MONDAY, 28 JANUARY

8:00 Symposium Registration and Morning Coffee

BATTERY RAW MATERIALS SUPPLY

9:30 Chairperson's Opening Remarks
Andrew Leyland, Head, Forecasting & Consultancy, Benchmark Mineral Intelligence

9:35 Lithium Market Outlook
Bart Vanden Bossche, Director, SQM

Over the last 20 years, the Lithium Market has proven to be very dynamic and an exciting future is anticipated. The Lithium demand is currently growing very rapidly, mainly driven by the electrification of vehicles. Investments in adding production capacity are being made to support the growth. Changing battery chemistries might further challenge the Lithium Industry. This presentation shares SQM's view on the Lithium Supply/Demand situation and its outlook for the coming years.

9:55 Cinovec – Developing Europe's Largest Lithium Resource
Keith Coughlan, Managing Director, European Metals Holdings Ltd.

European Metals Holdings Limited are developing the Cinovec Lithium-Tin deposit in Czech Republic. Cinovec contains the largest lithium deposit in Europe and is a historical underground tin mine. The Project is located in the north of the country on the German border and is in close proximity to a number of significant auto and battery manufacturers. Studies completed by the company indicate the potential of Cinovec to supply long-term, low-cost lithium to the European battery industry.

10:15 Nickel – From Solution to Solution
Anne Oxley, Technical Director, Brazilian Nickel

BEVs numbers are growing to help reduce emissions and improve our environment. The raw materials behind the EV revolution should also be produced with this in mind. Brazilian Nickel's hydrometallurgical process is at ambient conditions (no high temperatures or pressures) and results in dissolved battery metals in sulphate solution. BRN plans to produce nickel hydroxide products with high percent nickel for improved transportation. These products are easy to re-dissolve by the cathode manufacturers, but what are the other options and what is the best solution?

10:35 Networking Coffee Break with Poster Viewing

11:05 Advanced Conductive Agents Tailored for Automobile Applications
Sponsored by Denka
Akira Yoda, MA, Researcher, Battery and Conductive Materials, Special Conductive Materials, Denka

In order to expand zero-emission vehicles in the world, various tasks must be solved to increase battery properties. One of the most urgent issues is "range": we have identified that advanced conductive agents including DENKA's Acetylene Black can decrease the carbon black amount in the battery and increase its properties.

11:25 Nickel and Cobalt Feed for Batteries: Supply Reaction to the Rapidly Growing Industry and Impact on Other Consuming Sectors by 2020 and Beyond
Denis Sharypin, Head, Market Research, MMC Norilsk Nickel

This presentation will examine assessing potential risks of Ni and Co physical shortage in the light of the booming battery industry. In addition, the development of new projects: progress status, economics and issues as well as evaluating trends in major Ni & Co consuming industries will be presented.

11:45 Electrolyte for High Energy Density LiB
Sponsored by TINCI
Le Yu, Director, Research & Development, Guangzhou Tinci Materials Technology Co., Ltd

Dr. Yu Le will introduce Tinci R&D progress on electrolyte for high energy density LiB.He will show deterioration mechanism data and the solution.

12:05 Q&A

12:30 Networking Lunch

13:55 Chairperson's Remarks
Anne Oxley, Technical Director, Brazilian Nickel

14:00 Challenge Cobalt: The Major Supply Chain Issues Faced in 2019
Caspar Rawles, Analyst, Cobalt & Cathodes, Benchmark Mineral Intelligence

How real is the perceived problem with the DRC, artisanal sources and child labor? How will new cobalt supply impact the battery market in 2019? The move to 811 cathode chemistry: Why even the most bullish of adoption cases won't change cobalt's trajectory.

14:20 Benchmarking the Origination, Development and Purity Levels of Raw Materials Supply to Avoid Thermal Runaway and Stabilize Costs
Raymond Malcolm Oei, CEO, PT Stern

The compliance-based Electric Vehicle & Energy storage industry has to set benchmarking on the origination, development and purity levels of raw material supply to avoid thermal runaways and to economically decide to focus on abundantly available raw materials like Manganese to reduce the price/ kwh.

14:40 New Developments from Solvay Specialty Polymers to Further EV Battery Performances
Sponsored by SOLVAY
Giovanni Boccaletti, Customer Technical Development E&E, Auto, A/T, Batteries EMEA, Solvay Specialty Polymers, Solvay

15:00 Q&A

15:15 Refreshment Break with Poster Viewing

15:50 Chairperson's Remarks
Martin Steinbild, Director, Savannah Resources plc

15:55 Mina do Barroso - Spodumene Project in Portugal and the Impact on the Supply Chain in Europe
Martin Steinbild, Director, Savannah Resources plc

Savannah Resources' Mina do Barroso project in Portugal is a competitive lithium hard rock deposit. With this project, there is the opportunity to establish the supply chain for lithium ion batteries seamlessly in Europe. This supports the lithium raw material security for the battery industry and could be a low-risk entry point for the first spodumene conversion plant in Europe.

16:15 The Changing Landscape of the Cobalt Market
David Weight, President, Cobalt Institute

The presentation will look at the historical changes to the cobalt market over the past 20 years, noting specifically the impact that cobalt containing Li-ion battery development has had while looking at the challenges cobalt faces in the global market place, from chemical management to responsible sourcing.

16:35 PANEL DISCUSSION: Battery Raw Material Supply and Demand
Moderator: Martin Steinbild, Director, Savannah Resources plc
Panelists: Robert Baylis, Managing Director, Roskill Information Services Ltd., United Kingdom
David Weight, President, Cobalt Institute
Additional panelists to be announced

Electric mobility with lithium ion batteries is key for reducing GHG emissions to ease the impacts of climate change. Demand projections for electric vehicles show exponential growth. The fundamental question is: Can supply meet demand for battery raw materials? In this panel we highlight factors influencing demand, like autonomous driving without the need to own a car anymore, and raw material changes in future battery technologies. On the supply side, the panel will identify constraints in the value chain for main battery raw materials and ways of mitigating certain risks. A special focus will be on Europe's value chain.

17:10 Welcome Reception with Poster Viewing

18:15 Dinner Tutorial Check-In*

20:30 Close of Day

** Separate registration required, please see page 5 for details*

TUESDAY, 29 JANUARY

7:30 Symposium Registration and Morning Coffee

GLOBAL MARKET DEMAND FOR BATTERY RAW MATERIALS

8:30 Chairperson's Opening Remarks
Steven Sloop, PhD, President, Onto Technologies

8:35 Focus on Innovation to Lead a Rapidly Growing Technology-Based Industry of LiB
Marina Yakovleva, Global Commercial Manager for New Product and Technology Development, FMC Corporation

This presentation will focus on the Lithium industry outlook, FMC's product portfolio and technology roadmap for high energy density technologies as well as Lithium's future beyond lithium ion applications.

8:55 Financing 2030: How Much Money and Material is Needed to Make the EV Supply Chain Happen?
Andrew Leyland, Head, Forecasting & Consultancy, Benchmark Mineral Intelligence

The presentation will look at demand forecasts for nickel, cobalt, lithium and graphite out to 2030 and explore the challenges each industry faces in financing rapid expansions. From political risk to lack of access to debt capital, all major battery raw material markets face huge challenges in meeting future demand. With so much political and economic capital invested in EVs, can governments, OEMs and battery manufacturers allow raw material supply to fail to keep pace?

9:15 Europe's Battery Ecosystem: What a Shift in Production from Asia Means for The Lithium-Ion Battery Industry Supply Chain and Raw Materials
Robert Baylis, Managing Director, Roskill Information Services Ltd., United Kingdom

As European automotive OEMs announce their short- and long- term electrification plans, their chosen dominantly Asian cell suppliers are bringing cell and pack manufacturing plants to Europe to link into the existing automotive just-in-time platform. This paper looks at the evolving European supply chain ecosystem for batteries and the plans and opportunities for European raw material supply, in the context of geological, economic and other constraints, and the appetite of downstream consumers for provenance over price which may ultimately be the determining factor.

9:35 Battery Raw Materials – Pricing and Price Outlook
William Adams, Head, Base Metals & Battery Research, Fastmarkets MB

There is a lot of interest in how lithium, cobalt and other battery raw materials are priced, so in this presentation we will explain the process through to assessing the prices as well as providing our outlook on lithium and cobalt from a supply and demand and price forecast point of view. In addition, we will look at the key issues MB sees affecting the markets in 2019.

9:55 Q&A

10:10 Grand Opening Coffee Break with Exhibit & Poster Viewing

Sponsored by AVL

11:00 Chairperson's Remarks
Steven Sloop, PhD, President, Onto Technologies

11:05 Raw Materials Demand in an Electrified World – a Constraint to the EV Revolution?
Milan Thakore, Research Analyst, Battery Raw Materials, Wood Mackenzie

Automakers and governments are pushing towards an all-electric future, however our forecasts show that demand will rapidly outpace supply through the long-term. In this scenario, there will not be enough raw materials to supply battery producers and consequently, EV makers. This could result in a much slower uptake of EVs as cost fails to come down. We look at the changes required for the EV revolution to come to fruition and what impact they could have on demand.

11:25 Feasibility of Intercalated Metal-Organic Framework Raw Materials as Sustainably Available Novel Electrodes for Next-Generation Lithium-Ion Batteries
Nobuhiro Ogihara, PhD, Senior Researcher, Battery Materials & Processing Lab, Environment & Energy Department, Toyota Central R&D Labs

In this talk I will introduce the feasibility of intercalated metal-organic framework (iMOF) raw materials as novel electrodes. Since the iMOF electrode operates at 0.7-0.8 V vs. Li/Li+ and exhibits a capacity of about 200 mAh/g, it is possible to achieve both high safety margin due to suppression of internal short circuit caused by Li deposition and high voltage design as negative electrodes for Li-ion batteries. Finally, I will discuss the prospect of devices using iMOF electrodes for automotive applications.

11:45 The Development of the Lithium-Ion Battery Supply Chain in Europe and its Influence on Critical Raw Materials – Lithium, Nickel & Cobalt
Vincent Ledoux Pedailles, Vice President, Infinity Lithium

There are many positive indications of forward mobility by Europe, not just in terms of EV production, but also all across the lithium-ion battery supply chain, building a number of cross value chain alliances. The crucial next step is to back integrated production into cell components such as cathodes. Battery raw material production, such as nickel, is almost nonexistent in Europe. Is developing European based battery resources economically viable and how will a European based supply chain compete against a traditional Asian equivalent? Developing cross value chain alliances across the continent as well as securing sufficient investments with the right partners could be the start of a long process making Europe the cornerstone to electric mobility and energy storage, but many challenges are ahead.

12:05 Sponsored Presentation *(Opportunity Available)*

12:25 Q&A

12:40 Networking Lunch

13:55 Dessert Break with Exhibit & Poster Viewing

INNOVATIONS IN RECYCLING BATTERY MATERIALS

14:40 Chairperson's Remarks
Robert Baylis, Managing Director, Roskill Information Services Ltd., United Kingdom

14:45 Expected Recycling Feed Based on Today's Li-Ion Cathode Material Trends
Maarten Quix, Manager, Recycling Development, Umicore

The purpose of this presentation is to give an estimation of the expected metals need, but also the available feed for recycling in the years to come. Umicore is a leading company in the field of active materials for LIB as well as the recycling of LIBs and their associated production scrap. Today's cathode materials are using a complex mix of specific metals (Lithium, Nickel, Manganese and Cobalt) as raw materials, depending on the addressed application. A short example of Umicore's approach will be given to round up the presentation.

15:05 Treatment Strategies for Cost Efficiency in Original Manufacturing
Steven Sloop, PhD, President, Onto Technologies

Low-cost, high-throughput surface and chemical treatments have shown the ability to improve energy of low cobalt electrode formulations in comparison to baseline materials. The design features allow for improvements in material utilization through reuse of scraps from electrodes and batteries that can eliminate a 3% inefficiency in manufacturing.

15:25 Will Growth in Battery Recycling Ease Potential Bottlenecks in Raw Materials Supply Chain in Cell Manufacturing?
Asad Farid, Associate Director, Senior Analyst, Thematics Equity Research, Berenberg

While rising metal prices are slowing the downward cost trajectory of lithium-ion batteries, they are radically improving the economics of recycling. We think that the increased supply of recycled lithium and nickel from old EV batteries will negate the possibility of structural bottlenecks emerging in the supply of these metals. We estimate that 30% of the incremental demand for lithium and nickel in 10 years' time will be met by recycled metals.

** Separate registration required, please see page 5 for details*

15:45 The Role of Battery Recycling in Raw Material Supply for EV Applications

Zhangqi Wang, PhD, Research and Development, ACCUREC Recycling GmbH

Accurec has carried out an investigation in order to understand End-Of-Life battery market from EV application. In order to do so, data from battery Put-On-Market, battery life time and End-Of-Life scenarios were studied. Additionally, present available European lithium-ion battery recycling processes were summarized. Trends of (PH)EV battery pack evolution in the future were estimated according to available data. Outlooks and challenges for battery recycling industrial due to the massively expanded EOL (PH)EV lithium-ion battery market were also discussed.

16:05 Q&A

16:25 Networking Reception with Exhibit & Poster Viewing
(Sponsorship Opportunity Available)

17:25 Dinner Tutorial Check-In*

20:30 Close of Day

BATTERY ENGINEERING SYMPOSIUM

Building Better Batteries

MONDAY, 28 JANUARY

8:00 Symposium Registration and Morning Coffee

BATTERY SAFETY

9:30 Chairperson's Opening Remarks

Gregory Offer, PhD, Senior Lecturer, Mechanical Engineering, Imperial College London

9:35 Thermal Runaway Propagation in Li-Ion Batteries

Andreas Pfrang, PhD, Scientific Officer, Joint Research Centre, Directorate for Energy, Transport and Climate, European Commission

If thermal runaway occurs in a single cell inside battery assemblies, the heat generated typically cannot be easily dissipated and will lead to a temperature increase in adjacent cells. Such thermal runaway can cascade through the whole battery module or pack leading to significant heat and gas release. In this presentation, a model describing thermal runaway based on thermal data of reactions taking place in cells during thermal runaway is shown and thermal runaway initiation methods are compared. Finally, an overview of current standards on thermal propagation is given.

9:55 Calorimeters to Advance Thermal Management and Safety of Batteries

Carlos Ziebert, PhD, Head, Battery Safety Center, IAM-AWP, Karlsruhe Institute of Technology (KIT)

This talk will show how the calorimeters allow studying of the thermal runaway propagation to develop and qualify suitable countermeasures, such as heat protection barriers, which is currently becoming a very "hot topic." The acquired data are essential on all levels of the value chain, from safe design on materials level up to thermal management and adaptation of safety systems, or implementation into modelling and simulation tools.

10:15 Enhancing Cooling System Durability for Battery Packs and Fuel Cells

Michael Harenbrock, Business Development Manager, Mann+Hummel GmbH

Air and Liquid Cooling is required to keep Li Ion Battery Systems at the right temperature range to maintain system performance and to avoid system failure. The presentation will give an overview of the different cooling methods established – open and closed air cooling systems, direct and indirect cooling systems for battery systems. Failure modes caused by coolant contamination will be explained, and technical solutions for particle filtration, water adsorption and ion exchange will be highlighted.

10:35 Networking Coffee Break with Poster Viewing

11:05 Components to Improve Lithium Battery Safety

Peter Kritzer, PhD, Senior Application Manager, Sales Automotive, Freudenberg Sealing Technologies

The presentation will give an overview of products and approaches to improve battery safety. Beside cell separators, specially developed overpressure valves and heat shields, new concept ideas will be presented, which could improve battery safety on a higher level. Besides this, we will produce components enabling a reliable function of the batteries under normal operation.

11:25 Preventing Lithium Ion Battery Failure During High Temperatures by Externally Applied Compression

Gregory Offer, PhD, Senior Lecturer, Mechanical Engineering, Imperial College London

Lithium-ion cells can unintentionally be exposed to temperatures outside manufacturers' recommended limits without triggering a full thermal runaway event. The question addressed in this paper is: Are these cells still safe to use? In this study, externally applied compression has been employed to prevent lithium ion battery failure during such events.

11:45 How Silicone Materials are Answering the Performance and Assembly Requirements of EV Battery Packs

Sponsored by DOW

Julien Richeton, PhD, Technical Service & Development Scientist, Dow Performance Silicones, Dow Silicones Deutschland GmbH

High-energy density, more compact batteries requires gap fillers with higher thermal conductivity but also higher flow to fill intricate geometry. Thanks to their highly-tunable properties, silicone materials are in a position to offer the right balance between a long-term performance and a simplified assembly process.

12:05 Q&A

12:30 Networking Lunch

PACK ENGINEERING

13:55 Chairperson's Remarks

Wenzel Prochazka, Battery Manager, Battery Benchmarking Program, AVL List GmbH

14:00 Smart Sensing for Future Batteries

Yue Guo, PhD, Project Manager, Deputy Head, Energy Innovation Centre, WMG, The University of Warwick

A more effective battery thermal and structural deformation monitoring system by applying distributed optical fibre sensing techniques has been proposed and demonstrated in this paper, to meet the challenge hindering the mass adoption of lithium-ion or more advanced chemistries in future battery applications.

14:20 ANSYS Simulation Tools for Battery Development

Rolf Reinelt, PhD, Senior Application Engineer, Application Engineering, ANSYS Germany

ANSYS battery tools range from 3D field simulation (in CFD) to Reduced Order Model (ROM) extraction to system simulation. In particular it is possible to calculate the distribution of ohmic and electrochemistry sources in the battery. This allows us to accurately predict the temperature distributions in the battery and to assess the performance and durability. In our presentation we will give an overview of the underlying techniques and comprehensive system simulation methods for electric drivetrain and battery development.

14:40 Optimizing and Qualifying New Electrolyte Designs Faster with Advanced Analytics

Sponsored by voltaiq

Tal Sholklapper, PhD, CEO, Voltaiq

As global automotive OEMs race to electrify their fleets, there's a need for new electrolytes to enable safer, higher energy density batteries. In this presentation we will discuss how companies are putting together the data infrastructure and analytics environment that enables them to support electrification of the global automotive market.

15:00 Q&A

15:15 Refreshment Break with Poster Viewing

15:50 Chairperson's Remarks

Wenzel Prochazka, Battery Manager, Battery Benchmarking Program, AVL List GmbH

15:55 Homogeneity of Lithium Analysis in Lithium-Ion Batteries – A Study on Half Cells, Full Cells and Parallel Connected Cells of the Tesla Model S 85

Friedrich Hust, Chief Engineer, Modelling, Analytics and Lifetime Prediction, RWTH-Aachen, Institut für Stromrichtertechnik und Elektrische Antriebe

In this work, the inhomogeneous distribution of lithium on the electrodes of lithium-ion batteries is assessed by analyzing the voltage response in half-cells, full-cells, and parallel connected cells. A set of experiments has been conducted ranging from differential voltage analysis to voltage relaxation measurements and electrochemical impedance spectroscopy. This submission summarizes the former stated experiments, derives and explains the theory of homogeneity of lithium distribution.

16:15 A Challenge of Reliable Circuit Protection in Automotive Applications

Sponsored by AEM

Liwu Wang, PhD, Director, Business Development, Sales & Marketing, AEM Components (USA), Inc.

This presentation highlights some potential safety concerns in circuit protection associated with EV applications. It demonstrates how advanced "Wire-in-Air" fuse technology could yield much more consistent and reliable performance. The newly developed solid, robust structure of CMF fuses assure the best safe power density in higher power applications.

16:35 Effective Battery Control Instead of Monitoring the Death of the Battery

Hans Harjung, CEO, e-moove GmbH

Monitoring and balancing is state-of-the-art in battery management (BMS) since decades. In fact, this means monitoring the death of the battery. Effective battery control (ebc) is controlling all cells according to their individual state-of-health (SoH) and aging parameters. This leads to a maximum lifetime and performance of the battery pack combined with highest safety.

16:55 Q&A

17:10 Welcome Reception with Poster Viewing

18:15 Dinner Tutorial Check-In*

20:30 Close of Day

TUESDAY, 29 JANUARY

7:30 Symposium Registration and Morning Coffee

BATTERY MANAGEMENT SYSTEMS

8:30 Chairperson's Opening Remarks
Uwe Wiedemann, PhD, Managing Director, Munich Electrification GmbH

8:35 A Glance at Next Generation Battery Management System Requirements: Safety and Security
Uwe Wiedemann, PhD, Managing Director, Munich Electrification GmbH

8:55 Continued Glimpses into xEV Batteries on the Market – AVL Series Battery Benchmarking
Wenzel Prochazka, Manager, Battery Benchmarking Program, AVL List GmbH
The Program provides a database for objective comparison in technical attributes as well as in engineering methodology with market competitors for clear system target definition of high performing, reliable and safe batteries. 270 different criteria are evaluated through AVL benchmarking metrics displayed in 8 high level attributes. The found integrated system performance values in cell, mechanical and electrical system are pointed out to support current and future development programs. Example vehicles are the Tesla Model 3, Volkswagen e-Golf and Chevrolet Bolt.

9:15 High Power and Safe Li-Metal Batteries Part II: The Forgotten Concept of Three-Phase Boundary
Slobodan Petrovic, PhD, Professor, XNRGI
The power loss in lithium batteries comes partially from poor electronic conduction and limited active surface area. A new electrode consisting of porous structure and silicon collector is used to enable effective and high-area three-phase boundary between active mass, electrolyte and electronic conductor.

9:35 Digitalization as a Game Changer for Battery Cell and Battery Production
Kai Peter Birke, PhD, Electrical Engineering, University of Stuttgart
Many so-called developments in the field of Li-Ion battery cells and batteries still rely purely on trial and error. The reason is that some currently present battery cell production methods are extremely challenging to digitalize. Both new and modified production methods as well as digitalization can change the game and tremendously improve high volume production. However, digitalization counts on measurable values as well as a constant and optimized production flow. We will report and highlight examples of improving battery cell production by digitalization as well as sophisticated production flows.

9:55 Q&A

10:10 Grand Opening Coffee Break with Exhibit & Poster Viewing

Sponsored by
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CELL ENGINEERING

11:00 Chairperson's Remarks
Bob Spotnitz, PhD, President, Battery Design LLC

11:05 Roll-To-Roll Pre-Lithiation for Lithium Ion Battery Anodes
Jan Ronsmans, Technology Manager, Emerging Technologies, JSR Micro NV
This presentation will explain a new way for lithiation of lithium ion battery anodes. This method that can result in significant battery performance improvements and its applicability to an industrial mass manufacturing process is already demonstrated. The roll-to-roll pre-lithiation technique can be applied to a wide variety of anode materials and offers opportunities to reduce lithium ion battery manufacturing cost, such as excess loading of cathode due to low first-cycle efficiency of anode.

11:25 Next Generation of Primed Al/Cu Foils to Support the Battery Market Evolution
Thierry Dagron, Business Development Director, ARMOR Films for Batteries, ARMOR
In order to increase the energy density and cope with supply chain and safety regulations, most of the battery manufacturers look to develop nickel-rich cathodes, silicone-based anodes, higher voltages, water-based processes, etc. With such changes, new technical issues may occur at the interface between the electrode and the current collector. We demonstrate how primed current collectors (Al/Cu foils with a protective and conductive coating) solve these problems. ARMOR has developed specific primed Al/Cu foils for these new electro-chemistries. Benefits are longer cycle life, increased safety, fast charging, high power and energy density.

11:45 Continuous Mixing Process for LIB Electrode Slurries Contributes to Cost-Effective Cell Manufacturing
Philipp Stössel, PhD, Technologist Battery Solutions, Grinding & Dispersing, Bühler AG
The present production methods for lithium-ion battery (LIB) electrode slurries are largely based on batch processes. However, for the expected LIB market growth, especially in the automotive industry, these methods will no longer fulfill the requirements of the industry. Therefore, Bühler has developed a novel process based on a twin-screw mixer for fully continuous electrode slurry production. This process increases productivity per mixing line and eliminates batch-to-batch variations.

12:05 New Approaches in Battery Cell Production - From Standardization to Flexible and Agile Production Systems
Jürgen Fleischer, PhD, Manager, Machines, Equipment and Process Automation, Karlsruhe Institute of Technology

12:25 Q&A

12:40 Networking Lunch

13:55 Dessert Break with Exhibit & Poster Viewing

FAST CHARGING

14:40 Chairperson's Remarks
Kevin Konecky, Battery Systems Consultant, Total Battery Consulting, Inc.

14:45 xEV Industry Trends of Charging & Battery Systems
Kevin Konecky, Battery Systems Consultant, Total Battery Consulting, Inc.
Lithium-ion battery systems are an enabling technology in the propagation of xEVs with longer range and higher-energy-density batteries. Further enabling public acceptance are convenient and time-effective charging options. This presentation will review many xEVs currently in production and discuss trends and diversity in the subsystem design choices that were implemented in each production system including charge capabilities. Different charging protocols and standards across the globe will be discussed with trends analyzed, as well as improvements to user convenience including faster DC-charging and wireless charging.

15:05 Charge Fast but Don't Plate – How Validated Battery Models Can Solve the Dilemma
Michael Schoenleber, PhD, Co-Founder & CEO, Research & Development, Batemo GmbH
We will show that development time and effort can be drastically decreased by instead physically modelling a Lithium-Ion cell, proving the validity of the model in the whole operational range and subsequently using the model-predicted anode potential to investigate under which conditions Lithium-plating will start to occur. We will further show from that how charging strategies can be derived, that charge the battery truly as fast as possible while still avoiding Lithium-plating.

15:25 Presentation to be Announced
Peter Pichler, PhD, Manager, Samsung SDI Battery Systems

15:45 Requirements on Data Acquisition in Battery Management System
Jan Singer, PhD, Researcher, University of Stuttgart
Modern Battery Management Systems (BMS) have tremendous requirements for data acquisition rates and accuracy of measurements. The ASIL C demand for BMS thereby is one of the essential future challenges in automotive industry. Especially the monitoring of the cell voltage in order to keep charge and discharge limits is essential for safety (overvoltage) and lifetime (undervoltage). Unfortunately for both, high sampling rates and high accuracy increase costs and complexity of BMS due to expensive and complex electronic components.

16:05 Q&A

16:25 Networking Reception with Exhibit & Poster Viewing
(Sponsorship Opportunity Available)

17:25 Dinner Tutorial Check-In*

17:25 Close of Day

* Separate registration required, please see page 5 for details

CHEMISTRY & MATERIALS FOR LEAD-BASED BATTERIES

Lead-Based Batteries for Next Generation Commercial Applications

MONDAY, 28 JANUARY

8:00 Symposium Registration and Morning Coffee

ADVANCED LEAD-BASED BATTERIES R&D ROADMAP

9:30 Chairperson's Opening Remarks
Jochen Settelein, PhD, Expert Group Manager Lead-Acid Technology, Fraunhofer R&D Center Electromobility, Fraunhofer Institute for Silicate Research ISC

9:35 Lead-Based Batteries and The Future EU Regulatory Framework
Rene Schroeder, Executive Director, Association of European Automotive and Industrial Battery Manufacturers
The legislative framework of Battery and ELV Directives is under revision over the next couple of years, while the European Commission is about to take a decision on a potential exemption of all lead compounds in batteries under REACH. The presentation will assess and discuss these legislative developments and their impact on battery manufacturing, including lead-based batteries.

9:55 Review & Future Forecast for the Worldwide Lead-Acid Battery Market
Mark Lu, Industrial Economics and Knowledge Center and Industrial Technology Research Institute, Taiwan
This presentation will cover the current market of LABs worldwide: Shipment, scope and future growth analysis, In addition the demand trends of LAB applications: Automotive starter, industrial use, E-bike and other transportation tools, UPS and back-up power and rhe Chinese LAB industry will be discussed.

10:15 Feast or Famine Ahead For Lead? - Trends and Issues in The Global Lead Market
Neil Hawkes, Commodity Analyst, Lead, CRU
The 2018 step-down in LME lead prices has been largely driven by broader metal price drivers, casting lead's own somewhat supportive fundamentals to the side lines. The fortunes of the lead-acid battery sector, under threat from the rise of lithium-ion batteries, will be the key factor that determines the lead price path ahead. However, the response of production, both in polymetallic mining and in recycling, will be crucial in determining whether the lead market is facing feast or famine and lead prices looking down or up into the 2020s.

10:35 Networking Coffee Break with Poster Viewing

MARKET & APPLICATIONS

11:05 New Charge Regime With 87 % Efficiency for Forklift Lead-Acid Batteries
Juergen Garche, PhD, CEO, FCBAT
In the material handling sector, electric forklift trucks have a market share of > 50% and this with the heavy lead-acid battery system, which acts also as counterweight. A further increase of this electric market share is hindered by multi-shift operations which need ≥ 3 batteries caused by long charging and cooling times and the need of high energy LABs for high tonnage forklift trucks, where the cooling time is further increasing. With this PSOC operating regime, energy efficiencies of up to 87% can be achieved.

11:25 Progress of The Flooded Type Gen-2 UltraBattery for 14V-Hybrids
Satoshi Shibata, Deputy Manager of UltraBattery R&D Department, The Furukawa Battery Co., Ltd.
By optimizing the negative active mass additives, the 2nd generation UltraBattery achieved both excellent charge acceptability and water loss suppression. We also achieved the target with the very strict NEDC cycle life test. We refer to the mechanism of improvement of negative electrode as well.

11:45 Sponsored Presentation *(Opportunity Available)*

12:05 Q&A

12:30 Networking Lunch

13:55 Chairperson's Remarks
Juergen Garche, PhD, CEO, FCBAT

14:00 Advanced Lead to Li-Ion Batteries: Solutions for Any Hybrid Vehicle
Bernd Engwicht, Director Automotive Battery Application Engineering, East Penn Manufacturing Co.
East Penn's technologies, including EFB, Synergy, UltraBattery® and ArcActive that can provide single or dual battery solutions within varying vehicle architectures. While lead technologies have also demonstrated impressive results in 48V systems, Li-Ion may play a key role in higher voltage systems. East Penn discusses its role in the future of automotive electrification.

14:20 New Requirements for Li-Ion and PbA Batteries in the Standard Industrial Applications
Bernhard Riegel, PhD, Director, Research, Hoppecke Batterien GmbH & Co. KG
Electrochemical storage for industrial applications in the last decades has been dominated by well established technologies, i.e. mainly by Lead Acid, NiCd, NiMH and NaS. These technologies have been competing for decades with each other in the multiple fields of industrial applications. In our presentation we will report on future prospects for the deployment of lithium and advanced lead acid batteries in traditional reserve and motive power applications – a view from the perspective of an industrial batteries manufacturer.

14:40 Sponsored Presentation *(Opportunity Available)*

15:00 Q&A

15:15 Refreshment Break with Poster Viewing

15:50 Chairperson's Remarks
Juergen Garche, PhD, CEO, FCBAT

15:55 The New Challenge of Battery Selection for High Demand Applications
Ola Haggfeldt, Director, Europe, Transportation Division, NorthStar Group
This session will focus on the need to update lead battery ratings for next generation power hungry features. The concept of Lifetime Amp Hours and how they apply to the automotive industry will be presented and discussed.

MODIFIED ADDITIVES, MATERIALS & MODELLING

16:15 Physics-Based Modeling of a Thin Lead Electrode Using a Graphite Foil Current Collector
Mikaël Cugnet, PhD, Battery Expert, CEA (French Atomic Energy Commission)
Increasing the energy density of lead-acid batteries is still in progress. One way to reach this goal is the use of lightweight current collectors, such as graphite to replace lead. Understanding how thin-plate negative electrodes work is possible thanks to a physics-based model specifically designed with an open source software and the minimum number of equations required.

16:35 How Additives Can Enhance the Dynamic Charge Acceptance of EFB Batteries
Jochen Settelein, PhD, Expert Group Manager Lead-Acid Technology, Fraunhofer R&D Center Electromobility, Fraunhofer Institute for Silicate Research ISC
One major approach to improve the dynamic charge acceptance DCA of automotive batteries is the introduction of additives in the active material. Depending on the material, additives behave differently. They might act as seeding agent, surfactant, surface enhancer or pore builder. This talk will discuss how additives can help to improve the DCA and which properties are required in order to get the highest benefit. A current status of research and development is presented as well as latest results regarding high DCA additives.

16:55 Q&A

17:05 Alpha-Beta Society Membership Award Ceremony
Juergen Garche, PhD, CEO, FCBAT
The Alpha-Beta Society is an informal society of members who have made outstanding contributions to the development of the lead–acid battery system. The Society appoints only one new member per year. The name of the new member will be announced.

17:10 Welcome Reception with Poster Viewing

18:15 Dinner Tutorial Check-In*

20:30 Close of Day

** Separate registration required, please see page 5 for details*

TUESDAY, 29 JANUARY

7:30 Symposium Registration and Morning Coffee

MODIFIED ADDITIVES, MATERIALS & MODELLING (CONT.)

8:30 Chairperson's Opening Remarks
Stuart McKenzie, CEO and Managing Director, ArcActive

8:35 High Energy X-Ray Diffraction from Working Lead Batteries
Tim Fister, PhD, Materials Scientist, Chemical Sciences and Engineering Division, Argonne National Laboratory
I will discuss our studies of sulfation on model lead surfaces as well as XRD mapping on pasted grids from a motorcycle battery during operation. While these results largely focus on pack-level response, I will describe how emerging synchrotron techniques could provide an unprecedented view of atomic level growth and dissolution processes on individual particles.

8:55 Improving Lead Materials Development Through Use of Structural Characterization: Designing Better Lead Alloys
Matthew Raiford, PhD, Senior Process Engineer, Engineering, RSR Technologies
The presentation will discuss microstructural changes and the methods that can be utilized to monitor and quantify better lead sulfate dissolution and faster battery recharge. Examples of resulting alloys will be covered and the effect they have on battery performance.

9:15 Impact of Carbon Additives on Charge Acceptance Under Various Test Protocols
Aurelien Du Pasquier, PhD, Lead Scientist, Cabot
Carbon additives to the negative plates improve significantly in charge acceptance of lead-acid batteries and their cycle life under PSOC conditions. Various charge acceptance protocols used by the industry were applied to test and compare the performance of a series of carbon additives. The impact of carbon morphology and surface treatment on cold crank, water loss and cycle-life at 17.5% DOD were evaluated as well and compared to their performance under various charge acceptance protocols.

9:35 Standardization Work from National and International Perspective: Increased Market Share in Consequence of Safety Testing
Sven Ole Steinmüller, PhD, Expert Batteries and Electrical Energy Storage, VDE Renewables GmbH
Within this presentation an overview of the general standardization processes is given and additional how battery manufacturer and battery operators can participate in the standardization work. Besides an overview of relevant standards, examples of safety and performance tests for various battery types are shown. The presentation is concluded with the relevance of safety testing and risk assessment when aiming to increase market share.

9:55 Q&A

10:10 Grand Opening Coffee Break with Exhibit & Poster Viewing

Sponsored by AVL

HIGH-TEMPERATURE FIELD WATER CONSUMPTION

11:00 Chairperson's Remarks
Boris Monahov, PhD, Program Manager, Advanced Lead-Acid Battery Consortium (ALABC) – a program of the International Lead Association (ILA)

11:05 Gassing and Water Loss Measurements on Automotive Lead–Acid Batteries: Dynamic Cycling in Comparison to Steady-State Overcharging
Jonathan Wirth, Chair for Electrochemical Energy Conversion and Storage Systems, Institute for Power Electronics and Electrical Drives (ISEA), RWTH Aachen University
In recent studies, we have found that an oxygen cycle is taking place to a significant amount in modern Ca/Ca flooded lead–acid batteries. Also, correlation between common steady-state overcharge water consumption and water consumption in dynamic operation (e.g. simulated real-world urban and highway driving) is weak to non-existent for EFB+C batteries. We will give an update on our test results and present first results of candidate test runs for a new harmonized key life test.

TECHNOLOGY & INNOVATION: DCA VS. HIGH TEMPERATURE DURABILITY

11:25 Improving Dynamic Charge Acceptance Through Bipolar Architecture
Dan Moomaw, Head, Engineering, Gridtential Energy
One of the most significant new automotive markets is 48V mild hybridization. Lead-acid batteries have not been able to meet technology needs due to poor dynamic charge acceptance. Bipolar batteries can, through architectural changes, significantly improve DCA performance by improving active material utilization and decreasing cell-impedance. Gridtential will present its latest findings on DCA with regards to their Silicon Joule bipolar battery architecture as well as provide general recommendations for improving bipolar further.

11:45 Correlation of Impedance Spectroscopy and Dynamic Charge Acceptance
Sophia Bauknecht, Department of Electrical Energy Storage Technology, Technische Universität Berlin
First of all, the correlation between different charge acceptance tests and other testing methods, such as impedance spectroscopy, is investigated. Thus, several cells are tested concerning their DCA and impedance spectra before and after run-in. Secondly, the correlation for different cell and electrode setups is investigated. Therefore, size and symmetry effects of test cells are evaluated during the measurements. The results of this study will claim whether it is sufficient to use small test cells to test new materials or cell designs, since building complete batteries from each new test material is quite cost intensive.

12:05 Molecular Rebar® in Enhanced Flooded Batteries: Customer study on Enhanced DCA & Cycle Life using Molecular Rebar
Paul Everill, PhD, Vice President, Research & Development, Black Diamond Structures
Discrete carbon nanotubes can be dispersed in an aqueous solution and added directly to the pasting mix for either negative or positive lead-acid battery plates. These additives markedly improve the ability for batteries to be charged quickly, withstand cycling abuse better, reduce the growth of damaging sulfation, and ultimately provide more consistent performance resulting in longer life. These nanotubes, known as MOLECULAR REBAR®, can easily be incorporated into existing pasting lines. They have yielded benefits in full-scale production batteries in a wide variety of applications. This presentation focuses on shared customer development in Enhanced Flooded Batteries (EFB) using MOLECULAR REBAR® in the Negative Active Mass (NAM) to achieve EN DCA and Life Cycle targets.

12:25 Q&A

12:40 Networking Lunch

13:55 Dessert Break with Exhibit & Poster Viewing

14:40 Chairperson's Remarks
Rene Schroeder, Executive Director, Association of European Automotive and Industrial Battery Manufacturers

14:45 DCA Battery Data with Water Consumption with Carbon Fibre Based Negative Electrodes
Stuart McKenzie, CEO and Managing Director, ArcActive
Latest DCA (Homologation and Real World) Data along with Water Consumption and other key tests for batteries with ArcActive's Carbon Fibre based negative electrodes. Is this the technical solution to address both OEM DCA and water consumption requirements?

15:05 Suppression of High Temperature Water Loss in High DCA Lead Batteries for Micro-Hybrid Applications
Alistair Davidson, PhD, Products and Sustainability Director, International Lead Association
Boris Monahov, PhD, Program Manager, Advanced Lead-Acid Battery Consortium (ALABC) – a program of the International Lead Association (ILA)
This presentation will assess the current situation with regard to lead batteries in 12V automotive applications. It will review ALABC projects which have shown encouraging new results. These have included investigating a range of topics relevant to automotive lead batteries such as the effect of carbon and other additives, as well as of elevated temperature on water loss, the mechanism of early DCA decline and of hydrogen evolution at high temperature PSoC operation.

* Separate registration required, please see page 5 for details

15:25 PANEL DISCUSSION: Automotive Lead-Acid: Advancing Technology to Compete with Lithium Ion

Moderator: Christian Rosenkranz, PhD, Vice President Engineering & Product Development EMEA, Johnson Controls Autobatterien GmbH

Panelists: Eckhard Karden, PhD, Technical Expert Battery & Energy Storage Technology, Advanced Power Supply & Energy Management, Ford Research & Advanced Engineering, Europe

Rene Schroeder, Executive Director, Association of European Automotive and Industrial Battery Manufacturers

Boris Monahov, PhD, Program Manager, Advanced Lead-Acid Battery Consortium (ALABC) – a program of the International Lead Association (ILA)

Stuart McKenzie, CEO and Managing Director, ArcActive

The growth in start/stop batteries for the vehicle market has provided lead acid batteries with opportunities growth. This panel will examine what the technological advancements are such as DCA that will allow lead based batteries to gain market share and compete effectively in the energy storage marketplace.

16:25 Networking Reception with Exhibit & Poster Viewing
(Sponsorship Opportunity Available)

17:25 Dinner Tutorial Check-In*

20:30 Close of Day

xEV BATTERY TECHNOLOGY, APPLICATION, AND MARKET

WEDNESDAY, 30 JANUARY

8:00 Conference Registration & Morning Coffee

PLENARY SESSION: xEV BATTERY MARKET EXPANSION

8:40 Chairperson's Opening Remarks
Menahem Anderman, PhD, President, Total Battery Consulting, Inc.

8:45 Impact of the xEV Market Growth on Lithium-Ion Batteries and Raw Materials Supply 2019 – 2030
Christophe Pillot, Director, Avicenne Energy
Today less than 1% of the automotive market is Electric Vehicle. With this very small market share, xEV already consume more than 60% of the total Li-ion battery production, more than 40% of the Cobalt production and more than 50% of the Lithium production. With conservative xEV forecasts (5 Million EV sold per year in 2025), the impact on the Lithium ion battery market and supply chain will be huge.

9:05 Assessment of Direction and Requirements for PEV Market Expansion
Stephanie Schenk, Senior Research Analyst, Advanced Industries - Automotive & Assembly, McKinsey & Co.
Markus Wilthaner, Associate Partner, McKinsey & Co.
This presentation will provide an overview on the attraction of plug-in hybrid electric vehicles (PHEVs) compared to pure battery electric vehicles (BEVs) in different markets around the world. After outlining the current drivers of each technological solution (including the role of regulations and incentives, consumer requirements and automaker strategies), a scenario-based outlook on future electric vehicle (EV) adoption will be given. Results from a recent consumer survey among existing and prospective EV owners will highlight key buying criteria (e.g., design, cost, performance, etc.) for future market expansion.

9:35 Chinese xEV Market Expansion: Opportunity or Challenge?
Mark Lu, PhD, Certified Senior Industrial Analyst, Industrial Economics & Knowledge Center (IEK), Industrial Technology Research Institute (ITRI)
Driven by strong policies, the Chinese xEV market has captured over one half of the global market share and has attracted related international companies to consider the "Chinese strategy". However, such rapid promotion has also caused some difficulties. This presentation will point out each important issue and effectiveness in the Chinese xEV and related battery industries, and highlight the next possible steps of the Chinese xEV battery technical strategies.

10:00 Global & Regional Outlook for Plug-in Vehicles and Related Battery Trends
Victor Irle, Market Analyst, EV-volumes.com
This presentation will give insight into detailed sales statistics around the world of plug-in passenger cars and heavy vehicles; which models and markets are growing fast vs the laggards, and also the outlook in the different regions. The presentation will also use the sales data as an input to see the trends in battery demand, and which cathode chemistries are likely to grow in the future.

10:20 Coffee Break with Exhibit & Poster Viewing *(Sponsorship Opportunity Available)*

11:10 xEV Market Expansion
Menahem Anderman, PhD, President, Total Battery Consulting, Inc.
This presentation will assess the expansion of the xEV market. It will show that while xEV market expansion is now unstoppable, the pace of growth for each of the of xEV architectures is tied to i) regional-government regulations, ii) battery and vehicle technology and cost development, and iii) consumer eagerness. Predicting the growth of both the xEV market and the batteries that will power the vehicles is thus tied to anticipating development in the above three areas. We will attempt to provide some likely scenarios and estimate the resulting battery and xEV markets.

11:35 Price Elasticity of Supply for Cathode Materials in a Fast-Growing Vehicle Electrification Scenario
Kurt Vandeputte, Vice President, Rechargeable Battery Materials Business Unit, Umicore
Vehicle electrification is growing at a healthy pace which translates into unseen growth rates of cell making. Consequently, demand for the different cathode materials is high which in turn leads to imbalances on the market for key raw materials like lithium, nickel and cobalt. For all these critical materials the emerging battery industry will be the dominant downstream use. Since these materials contribute significantly to the total $/KWh-cost of the battery, it is critical to have good insights in the fundamental characteristics of these respective markets. In this presentation current and future supply/demand balances will be discussed, price elasticity of supply scenarios and its consequences towards battery cost curves will be highlighted.

11:55 Q&A

12:20 Networking Lunch *(Sponsorship Opportunity Available)*

13:30 Dessert Break with Exhibit & Poster Viewing

xEV BATTERIES

14:15 Chairperson's Remarks
Matthias Ullrich, PhD, Manager, Traction Battery Technology Development Electric/Electronics, Volkswagen

14:20 Future Trends in Battery Electronics
Marco Thoemmes, Head, Development Electrics/Electronics HV Storage Systems, Audi AG
This presentation will discuss meeting market requirements and customer expectations, new electronic architectures for high-voltage battery systems, and how to overcome the new challenges to be faced.

14:40 Renault EV - Lessons Learned from Field Data Analysis, and Future Challenges
Bruno Delobel, PhD, Electrochemistry Junior Expert, Renault
The first Renault EV vehicle was launched in 2011 and a total of more than 150k EVs have been delivered so far. In order to better design future batteries and to anticipate battery usage, a deep analysis of the current customers' usage is a key point. This presentation will show the status from the field of i) durability, and ii) field experience usage. To conclude this presentation, we will focus on future challenges for electrified vehicles.

15:00 Batteries for Automotive – Roadmap towards Next Generation
Zin Park, PhD, Managing Director, Vice President, Samsung SDI Europe GmbH
Automakers are aggressively pursuing electrification strategies to respond to market changes. Samsung's efforts are focused on: achieving higher energy density to extend the electric range, a more flexible design to provide solutions for every vehicle segment, high-energy multifunctional modules that maximize the merits of prismatic cells, advanced built-in safety devices for high-energy automotive batteries, faster charging capability, and long-term R&D commitment.

Sponsored by ENEVATE

15:20 Pure Silicon Technology for Automotive Applications - Energy Density, Extreme Fast Charge, and Safety
Jarvis Tou, Executive Vice President, Enevate Corporation
The speaker will discuss a pure silicon Li-ion battery technology with binder-free anodes. Unique properties of cells made using this technology will be shown including energy density, extreme fast charge capability, and safety. Information will be shown showing how the technology breaks down barriers to mass adoption of electric vehicles.

15:40 Refreshment Break with Exhibit & Poster Viewing

16:30 2025 xEV Battery Characteristics
Menahem Anderman, PhD, President, Total Battery Consulting, Inc.
While the fundamental cell technology and manufacturing processes have barely changed since their 1991 market introduction, Li-ion batteries have been on a continuous path of technology improvement and cost reduction.

Their compelling characteristics have made them the technology of choice for most applications including hybrid and electric vehicles. This presentation will explore how much further the technology can evolve and whether or not a shift to a different chemistry or a drastic change in electrolyte, anode, or cathode composition are feasible in the next 8-10 years.

16:50 Heat Dissipation Research on LLTT (Longer Length & Thinner Thickness) Battery
Shiliang Zhou, PhD, Deputy Manager, SZD (Shenzhen Battery Development Center), Division 2 Battery Business Group, BYD Lithium Battery Co. Ltd., Kengzi Branch

17:10 Incorporating New Technologies into the Development of HV-Batteries
Nikolas Sariyannis, Project Manager, ECI-BATT, AVL Deutschland GmbH
This presentation will provide an overview of the challenges existent in the development of small-batch serial development, a field with high potential to apply disruptive technologies and where it will be needed to use new development methods not considered until now.

17:30 Q&A

18:00 Networking Reception with Exhibit & Poster Viewing *(Sponsorship Opportunity Available)*

19:00 Close of Day

THURSDAY, 31 JANUARY

7:30 Registration Open

8:00 Breakfast Roundtable Discussions
Join your colleagues and fellow delegates over breakfast for a focused, informal discussion moderated by a member of our speaking faculty. A small group format allows participants to meet potential collaborators, share examples from their own work and discuss ideas with peers. Visit our website to see the full listing of topics and moderators.

9:00 Chairperson's Opening Remarks
Eckhard Karden, PhD, Technical Expert for Battery & Energy Storage Technology, Ford Research Aachen

9:05 Impact of New Vehicle Features on the Overall Electrical Power Consumption
Ludwig Brabetz, PhD, Professor, FB Elektrotechnik/Informatik, Kassel University
This prentation gives an analysis about the overall power requirements of conventional and new electrical functions within the 12V or 12V/48V supply system. In particular, it describes a statistical prognosis for the expected power distribution in order to provide a database for the dimensioning and test of critical components such as batteries and alternators.

9:25 Application of Advanced Flooded Type Lead-Acid 12V Batteries – Development Cases from a European/Japanese Cooperation
Silvia Cazzanti, PhD, Product Innovation Manager, R&D, Fiamm
A preliminary overview of the FIAMM Energy Technology and Hitachi Chemical joint venture is presented focusing on the main strategies and perspective regarding to the European automotive market. Subject of the presentation is the joint development of Advanced Flooded type Lead–Acid Batteries for 12V micro-hybrid vehicles. These technologies enable to save fuel consumption and CO2 emission, as well as enhanced reliability (robustness against undercharge issues). The progress made so far through the integration of Hitachi and FIAMM technologies into advanced high chargeability LN-size batteries is presented showing the design features of the new joint design and performances results collected in terms of dynamic charge acceptance and high temperature tests. These performances were then linked to the vehicle application through the execution of the WLTS test that reproduces the essentials of WLTP battery conditioning and cycle properties (duration and distribution of regenerative pulses). The comparison in WLTS profile of the new developed battery versus the current EFB battery present in the market shows vehicle-level benefit generically, in a 2021 perspective of CO2 emission decrease to 95g/km.

9:45 Battery Selection for the Optimization of the 48V/12V Vehicle Power Net
Christina Antonius, PhD, Manager Requirements Analysis, Johnson Controls Advanced Power Solutions GmbH
Johnson Controls has explored the question of battery key parameters and interactions of subsystems. We will present two scenarios for the split of functions. On a lab bench a set up for the subsystems has been realized and different batteries and combinations tested against a drive profile. The amount of power in both systems will be analyzed and discussed, also in regards of performance of the DCDC converter. An outlook on the appropriate optimization of the total system with respect to battery sizing will be given and reviewed.

10:05 Advanced 48V Battery Systems – Requirements & Concepts
Christoph Fehrenbacher, Executive Director, European Technical Center, A123 Systems
Fuel economy and CO2 emission legislation are driving the adoption of 48V mild hybrid systems globally. Some vehicle manufactures with a portfolio of rather large and heavy vehicles have already publicly announced that they will roll out 48V across the board for all non (PH)EV vehicles, other OEMs will likely follow. 48V mild Hybrid Electric Vehicles (mHEV) will become mainstream. The 48V battery system requirements are closely related to the mHEV system architecture (P0 to P4). Advanced mHEV architectures in combination with increased 48V feature content are for example driving higher energy and power requirements for the 48V battery. This presentation will discuss battery system requirements, Li-ion chemistry options and battery design concepts for advanced 48V Li-ion battery systems."

10:25 Coffee Break with Exhibit & Poster Viewing

Sponsored by A123 SYSTEMS

11:10 48V Battery Architecture of Continental and CALB
Dr. Klaus Greger, Head of Battery Engineering, Business Unit Hybrid Electric Vehicle, Powertrain Division, Continental Corporation
Beyond 2022 more than 50% of light vehicles powertrains will have some degree of electrification. Besides Battery Electric Vehicles (BEV) and Plug-in Hybrid Electric Vehicles (PHEV), Mild Hybrid Electric Vehicles (mHEV) will be the most important variants in the near future. The Mild Hybrid application is a very cost-efficient solution combining the goals of emission reduction while remaining high dynamic drive behavior. In the talk, Continental will present its battery platform solution for all mHEV variants (P0 to P4) together with CALB as cell supplier. Focus topics will be thermal management, crush, current disconnect device and cell design.

11:30 Presenation to be Announced

11:50 The 48V-System is the First Step Towards Completely Electric Powertrain
Arpad Imre, PhD, Powertrain Solutions, Engineering System Powertrain (PS/EPP), Robert Bosch GmbH
The 48V hybrid electric powertrain systems are affordable, have several benefits, new functions, and reduce the CO2 emission of conventional vehicles. Due to these facts, a huge number of the new internal combustion engine vehicles going to be equipped with such low voltage hybrid powertrain systems. The influence of the HEV topology, car segment, drive cycle, various use cases and auxiliaries on the future battery solutions will be presented and discussed in this contribution.

12:10 Q&A

12:40 Networking Lunch *(Sponsorship Opportunity Available)*

13:25 Dessert Break with Exhibit & Poster Viewing

BATTERY DURABILITY AND RELIABILITY

13:55 Chairperson's Remarks

Andreas Jossen, PhD, Professor, Electrical Engineering and Information Technology, Technical University Munich

14:00 The Influence of the Entropic Effect on Battery Performance

Andreas Jossen, PhD, Professor, Electrical Engineering and Information Technology, Technical University Munich

The reaction entropy while charging and while discharging within lithium-ion batteries depends on the state of charge and it has a significant influence on the battery characteristic. Next to the strong influence on the heat generation, it directly influences the open circuit voltage. These effects can be used to measure the entropic coefficient, to do SOH diagnostics, but also result in inhomogeneities. The presentation will show how to measure the entropic coefficient, how it can be used for SOH determination and possible effects within cylindrical cells that result in a reversible but also in irreversible aging.

14:20 Diagnosis of Li-Ion Battery health with Nonlinear Frequency Response Analysis

Ulrike Krewer, PhD, Professor, Technical University Braunschweig

This talk demonstrates that nonlinear frequency response analysis (NFRA) is a highly potent method for analyzing the state of health of Li-ion batteries. The nonlinear dynamic method is sensitive to changes at electrode surfaces. After introducing typical spectra and their interpretation, the potential of the method for monitoring and discriminating between aging processes in cells is demonstrated in the example of cycling-aged vs. Li plated cells: While in both cases the recorded EIS look qualitatively similar, NFRA shows distinct qualitative features.

14:40 Mechanical Ageing of Jelly Rolls in Lithium Ion Battery Cells

Egbert Figgemeier, PhD, IEK-12: Ionics in Energy Storage - Ageing and Lifetime Prediction of Batteries, Forschungszentrum Jülich GmbH

In the current presentation the impact of inhomogeneous mechanical properties in a Lithium ion battery cell on degradation will be discussed. The roll of expansion and contraction of the jelly roll during charge/discharge-processes will be illuminated. It will be shown how charge/discharge cycling contributes significantly to geometric changes of the electrode jelly roll and how the volume changes of the electrode layers play a significant role in degradation.

15:00 Q&A

15:15 Refreshment Break

CLOSING PLENARY SESSION: BATTERY LOGISTICS AND INFRASTRUCTURE

15:30 Chairperson's Remarks

Chairman: Roland Matthe, Technical Fellow Battery System & Mgr Electrification Architecture, Engineering Propulsion Systems, Opel Automobile GmbH

15:35 Charging Infrastructure in Europe: Development, Trends, and Outlook

Johanna Heckmann, Senior Consultant eMobility & Team Lead Charging, P-3

Charging infrastructure is an essential element of the electric mobility eco system. The development of the infrastructure network in Europe gained speed with new players, such as Shell and ionity, entering the market and with ongoing funding projects and political expansion plans. Where are we standing? What are the latest developments, especially regarding high power charging along main traffic axes and what are the latest trends, that will influence the market? With relevant insights and outlooks to the charging infrastructure in Europe, the proposal gives an impression of one of the most important requirements to make electric mobility a success: The availability and accessibility of appropriate charging infrastructure.

15:55 Li-Ion Battery Air Shipment Regulations

David Brennan, Asstistant Director, Cargo Safety & Standards, International Air Transport Association

Transport regulators continue to look at the potential hazards, and risks, posed by the transport of lithium batteries. Air transport regulators, through ICAO continue work on the development of a standard that can be used to test batteries as prepared for air transport to validate that the batteries do not pose an unacceptable risk. In parallel the United Nations Subcommittee of Experts on the Transport of Dangerous Goods is considering revisions to lithium battery classification to develop a hazard-based approach to the classification of lithium batteries, and by extension to the transport conditions. This presentation will look at potential developments to revise the transport regulations applicable to lithium ion batteries across all modes of transport with then a focus on air transport.

16:15 EV Wireless Charging Drives the Future of Mobility

Peter Wambsganss, Director, Business Development AIMM - Europe Region, WiTricity Corporation

WiTricity is focused on improving the EV ownership experience—no more cables, and no worry about charging. We also recognize that the future of mobility is electrified, autonomous and shared, and wireless charging is an essential enabler for fleets of robotaxis where there is no driver to plug in. EV wireless charging is an enabler for broad consumer EV adoption, lowering our carbon footprint, and can act as a catalyst for Vehicle to Grid which is important for expanding renewable energy sources. We believe that V2G will be a game changer for EVs as it transforms cars into energy management systems, and not just forms of transportation.

16:35 Q&A

16:50 Closing Remarks

16:55 Close of Conference

EV TECHNOLOGY FOR SPECIALTY APPLICATIONS

Commercializing Advanced High-Energy Batteries for Heavy & Light EVs

WEDNESDAY, 30 JANUARY

8:00 Conference Registration & Morning Coffee

PLENARY SESSION: xEV BATTERY MARKET EXPANSION

8:40 Chairperson's Opening Remarks
Menahem Anderman, PhD, President, Total Battery Consulting, Inc.

8:45 Impact of the xEV Market Growth on Lithium-Ion Batteries and Raw Materials Supply 2019 – 2030
Christophe Pillot, Director, Avicenne Energy

Today less than 1% of the automotive market is Electric Vehicle. With this very small market share, xEV already consume more than 60% of the total Li-ion battery production, more than 40% of the Cobalt production and more than 50% of the Lithium production. With conservative xEV forecasts (5 Million EV sold per year in 2025), the impact on the Lithium ion battery market and supply chain will be huge.

9:05 Assessment of Direction and Requirements for PEV Market Expansion
Stephanie Schenk, Senior Research Analyst, Advanced Industries - Automotive & Assembly, McKinsey & Co.
Nicolo Campagnol, PhD, Knowledge consultant, Battery materials expert, McKinsey & Company

This presentation will provide an overview on the attraction of plug-in hybrid electric vehicles (PHEVs) compared to pure battery electric vehicles (BEVs) in different markets around the world. After outlining the current drivers of each technological solution (including the role of regulations and incentives, consumer requirements and automaker strategies), a scenario-based outlook on future electric vehicle (EV) adoption will be given. Results from a recent consumer survey among existing and prospective EV owners will highlight key buying criteria (e.g., design, cost, performance, etc.) for future market expansion.

9:25 Chinese xEV Market Expansion: Opportunity or Challenge?
Mark Lu, PhD, Certified Senior Industrial Analyst, Industrial Economics & Knowledge Center (IEK), Industrial Technology Research Institute (ITRI)

Driven by strong policies, the Chinese xEV market has captured over one half of the global market share and has attracted related international companies to consider the "Chinese strategy". However, such rapid promotion has also caused some difficulties. This presentation will point out each important issue and effectiveness in the Chinese xEV and related battery industries, and highlight the next possible steps of the Chinese xEV battery technical strategies.

9:45 Global & Regional Outlook for Plug-in Vehicles and Related Battery Trends
Victor Irle, Market Analyst, EV-volumes.com

This presentation will give insight into detailed sales statistics around the world of plug-in passenger cars and heavy vehicles; which models and markets are growing fast vs the laggards, and also the outlook in the different regions. The presentation will also use the sales data as an input to see the trends in battery demand, and which cathode chemistries are likely to grow in the future.

10:05 Coffee Break with Exhibit & Poster Viewing *(Sponsorship Opportunity Available)*

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Menahem Anderman, PhD, President, Total Battery Consulting, Inc.

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11:35 Price Elasticity of Supply for Cathode Materials in a Fast-Growing Vehicle Electrification Scenario
Kurt Vandeputte, Vice President, Rechargeable Battery Materials Business Unit, Umicore

Vehicle electrification is growing at a healthy pace which translates into unseen growth rates of cell making. Consequently, demand for the different cathode materials is high which in turn leads to imbalances on the market for key raw materials like lithium, nickel and cobalt. For all these critical materials the emerging battery industry will be the dominant downstream use. Since these materials contribute significantly to the total $/KWh-cost of the battery, it is critical to have good insights in the fundamental characteristics of these respective markets. In this presentation current and future supply/demand balances will be discussed, price elasticity of supply scenarios and its consequences towards battery cost curves will be highlighted.

11:55 Q&A

12:20 Networking Lunch *(Sponsorship Opportunity Available)*

13:30 Dessert Break with Exhibit & Poster Viewing

SPECIALTY MARKET OVERVIEW

14:15 Chairperson's Remarks
Jens Groot, PhD, ESS Specialist, Volvo Group Trucks Technology

14:20 Electric Bus and Light Electric Vehicles: Disruptors in a Future Car Congested World
Franco Gonzalez, Principal Analyst, IDTechEx
Luke Gear, Technology Analyst, IDTechEx

This presentation will look at the emerging markets of electric buses and electric two-wheelers. We will present some of the technology and market trends in this sector by focusing not only in advanced markets like Europe, but the emerging markets in which these disruptive trends could have a larger impact for the automotive passenger car sector: China and India.

14:40 Beyond the EV: Identifying Energy Storage Opportunities in Marine, Aviation, and Heavy-Duty Transport
Christopher Robinson, Analyst, Energy Storage, Lux Research

Hybridization and electrification have made significant impacts on the passenger vehicles and the broader automotive industry, but is rapidly expanding to other segments in mobility. Motivated by regulations reducing emissions and potentially lower operating and lifetime costs, other sectors feeling the impact of electrification include the marine, aviation, and commercial transport industries. This discussion will focus on the most promising opportunities for hybridization and electrification, and explore which energy storage and powertrain technologies are best suited to meet those needs.

15:00 The Emerging Battery Markets Beyond xEV
Axel Thielmann, PhD, Deputy Head, Competence Center for Emerging Technologies, Fraunhofer Institute for Systems and Innovation

This talk will provide an updated overview of the emerging battery markets beyond xEV. The status of battery market demand and future dynamics of commercial electric vehicles, buses, trucks, ebikes, industrial to stationary applications is discussed. How do key battery performance parameters develop and which battery technology will be suitable for the upcoming applications? Which are the main cell producers and OEM and how do the markets develop compared to the xEV market?

15:20 Molecular Rebar® in Enhanced Flooded Batteries: Customer study on Enhanced DCA & Cycle Life using Molecular Rebar
Tal Sholklapper, PhD, CEO, Voltaiq

15:40 Refreshment Break with Exhibit & Poster Viewing

16:30 How Will Different Utilization Rates of Transport, Industrial and Autonomous Electric Vehicles Impact the Design and Service Policy of Advanced Battery Packs
Dirk Spiers, President, Spiers New Technologies

16:50 Electrifying Maritime Transportation – Challenges and Meeting Customer Needs
Pavel Calderon, Lead Innovation Manager, ABTERY
Electrifying the boat fleet is not only about climate and CO2 emissions, but also about keeping our waters clean and taking better care of sea life. At Abtery, we are developing turnkey-ready powertrain systems solutions for electric boats and ferries. We will share our insights and experience so far, current status of the market and highlight future challenges.

17:10 Bus Battery Market 2018
Shmuel De-Leon, CEO, Shmuel De-Leon Energy, Ltd.

17:30 Q&A

18:00 Networking Reception with Exhibit & Poster Viewing
(Sponsorship Opportunity Available)

19:00 Close of Day

THURSDAY, 31 JANUARY

7:30 Registration Open

8:00 Breakfast Roundtable Discussions
Join your colleagues and fellow delegates over breakfast for a focused, informal discussion moderated by a member of our speaking faculty. A small group format allows participants to meet potential collaborators, share examples from their own work and discuss ideas with peers. Visit our website to see the full listing of topics and moderators.

9:00 Chairperson's Opening Remarks
Dirk Spiers, President, Spiers New Technologies

OEM PERSPECTIVES ON SPECIALTY BATTERY DEVELOPMENT

9:05 Thermal Simulations of Novel Cooling Concepts for Heavy-Duty xEVs
Jens Groot, PhD, ESS Specialist, Volvo Group Trucks Technology
Battery packs for heavy-duty applications xEVs are often especially challenging to design from a thermal perspective; high average power, very high peak power, short charging rates, large volume, physical arrangement in several sub-packs and operation in diverse operating conditions. This presentation will cover some recent research activities within the Volvo Group related to Novel cooling concepts, including the use of phase-change materials, thermal simulations on pack level for large xEV battery packs and suggested future focus areas for battery research.

9:25 Battery Challenges for HD xEVs
Fernanda Lodi Marzano, PhD, Development Engineer, Materials Technology R&D, Scania

LIB CHEMISTRIES AND ALTERNATIVE TECHNOLOGIES

9:45 Development of Cutting Edge Battery Packs Using Next-Generation Cell Chemistries
Wasim Sarwar, PhD, Senior Battery Systems Engineer, Williams Advanced Engineering
Williams Advanced Engineering is focused on the development of the world's most power-dense and energy-dense batteries through the advancement and implementation of next-generation cell chemistries. This talk will explain how the design, monitoring and control of battery systems will evolve as we shift from typical transition-metal oxide, graphite + SiOx li-ion cells, to next-generation cells (Si-dominant anode & Semi-Solid-State Systems).

10:05 Intelligent Flexibility Platforms Are Necessities for EV Uptake
Kotub Uddin, PhD, Head of R&D, R&D, OVO Energy
Along with our partners, Nissan, we produced and supply domestic V2g chargers. Along with our partners, BP and Chargmaster - we produced and supply domestic smart chargers. Auto OEMs (VW, Nissan and Daimler - in conversations with us) have outlined how the grid will be a challenge to EV uptake. This needs to be presented and discussed. Before joining OVO Energy (Feb 2018), I was an academic and have published many technical papers in the areas of battery degradation, EVs and grid systems. I'll be presenting new data.

10:25 Coffee Break with Exhibit & Poster Viewing

Sponsored by A123 SYSTEMS

LIGHT ELECTRIC VEHICLE (LEV) BATTERY SYSTEMS & CHARGING

11:10 Outlook for LEV Market and Standard 18650/21700 Cylindrical Li-Ion Battery Developments
Mo-Hua Yang, General Manager, TD HiTech Energy, Inc.; President, EnergyBus e.V.
In order to overcome the material limitation in the further capacity increasing and battery pack system cost down, a new form factor of standard battery 21700 has been proposed by battery and EV manufacturers. In spite of the blooming of EVs, LEV (E-bike) as E-personal mobility has received attention in urban mobility for the first and last mile connection to the public transportation system. The LEV market trend and 18650/21700 Li-ion battery development status will be discussed in this presentation.

11:30 48V Multi Pack System with Dynamic ID Designation & Intelligent Charging for e-Scooters, e-Boats and Last Mile Delivery Vehicles
Maarten Kelder, CTO, Mechanical, Electronic Engineering & Production, Cleantron
Cleantron develops and produces in Amsterdam Modulair Batteries (24-72V) with MPS (Multi-Pack System); every Module is equipped with an Advanced Cleantron BMS allowing Inter-Module Communication for Dynamic ID Designation, Cycle Intelligent Charging in between the modules and optimal safety. The system is used in e-Scooters (2 Modules) as well as in e-Boats and electric Last Mile Delivery Vehicles (up to 16 Modules) offering full flexibility in fleet management.

HEAVY ELECTRIC VEHICLE (HEV) & INDUSTRIAL BATTERY SYSTEMS

11:50 Distributed Storage – A Future for Grid Connected Batteries
Varun Raghunath, Program Management Engineer, GE Power
Increased penetration and use of Electric Vehicles (EVs) presents new opportunities for grid-connected storage. The challenges of using EV batteries include building and installing necessary infrastructure, minimum size of fleet for this to be effective, effect on battery life and required design, and establishing the marketplace and control for such a system to exist. This presentation will elaborate on these topics and will highlight on certain paths being taken in this direction.

12:10 Q&A

12:40 Networking Lunch *(Sponsorship Opportunity Available)*

13:25 Dessert Break with Exhibit & Poster Viewing

13:55 Chairperson's Remarks
Franco Gonzalez, Principal Analyst, IDTechEx

14:00 High-Energy Batteries Versus High-Power Batteries in Daily Operation for Heavy EVs and Industrial Applications
Filip Jankun, e-Mobility Business Unit Manager, Impact Clean Power Technology S.A.
When choosing the right Li-ion battery for an application, one has to choose between different chemistries, cell formats, lifetime etc. Although high-energy batteries sometimes seem to be predestined regarding space, weight and investment costs, high-power batteries with a high cycle life often result in lower TCO. Examples from battery systems for heavy applications in public transportation and industrial applications show the commercial and technical superiority of high performance batteries.

14:20 Prototyping and Industrialization of Solid State Battery Technology for Performance BEV and Electric Aircraft Propulsion System Applications

Robert Stanek, Partner, Lead ePowertrain, eMobility, P3 automotive GmbH

The technology maturity and feasibility of mass production of solid state battery technology is one of the greatest mind-term challenges for electric propulsion systems, both on land and in the air. After prototyping has led to the desired battery cell design, the industrialisation and production ramp-up are the next milestones before reaching series production. Together with strong partners, P3 has developed the skills to assess the feasibility of such next-generation battery production. Lastly, the application of mass produced next-generation battery technology for high-performance powertrain systems will be considered.

14:40 Improved Rate Capability and Cycle Life of Automotive Li-Ion Batteries Through Improved Thermal Management, Diversifying Cell Use Cases for Marine and Aerospace Applications

Alexander Holland, Research Assistant, Mechanical Engineering, Imperial College London

Experimental research assessing the feasibility of achieving increased cycle life and power density of high energy density, low C-rate capable automotive pouch cells through improved thermal management. Our work enables the potential use of these cells in demanding high C-rate applications such as electric ferries, aerospace and EV fast charging.

15:00 Q&A

15:15 Refreshment Break

CLOSING PLENARY SESSION: BATTERY LOGISTICS AND INFRASTRUCTURE

Please see page 17 for details.

16:50 Closing Remarks

16:55 Close of Conference

POSTER INFORMATION

PRESENT A POSTER AND SAVE €150

AABC 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 **14 December 2018.**

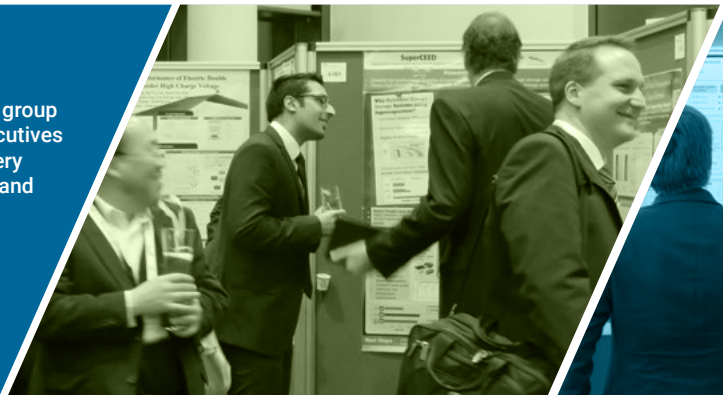
Register online, or by phone, fax or mail. Please indicate that you would like to present a poster. Once your registration has been fully processed, we will send an email with a unique link and instructions for submitting your abstract using our online abstract submission tool. Please see below for more information.

Students* presenting a poster can attend AABC Europe for as little as €299.

*Full-time graduate students including Masters, PhD candidates and post-docs are eligible for the student poster rate. A poster is required.

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

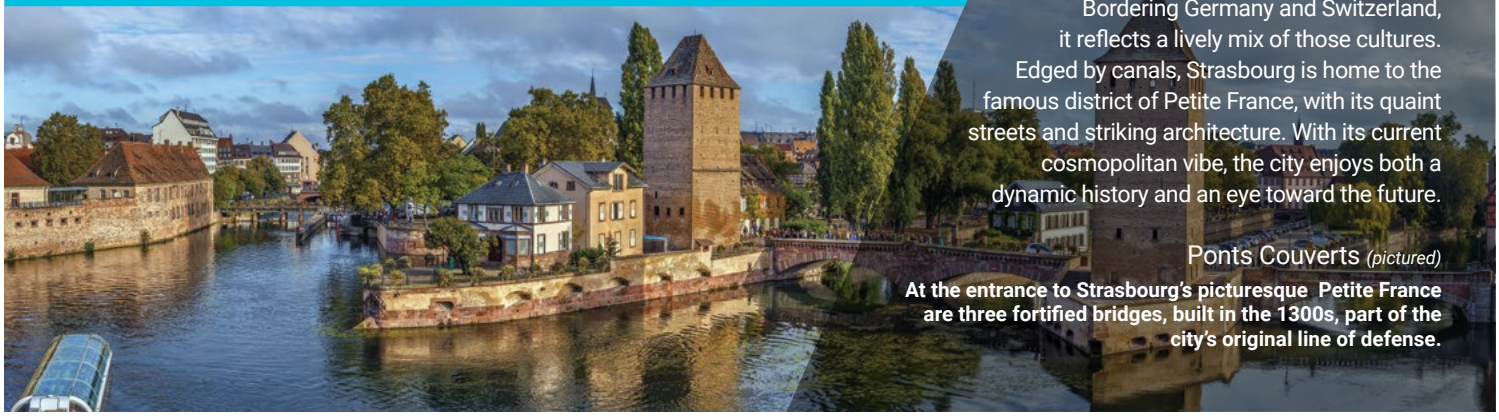
- Your poster will be seen by this exclusive group of technical and business development executives from major European and international battery companies, automotive technology centers and the global materials and energy industries.
- Receive €150 off your Commercial or Academic/Government registration.
- Your poster abstract will be published in our conference materials.



Get Plugged-In at AABC Europe in Strasbourg, France!

Network with 1,000+ Battery Technologists from the Entire Supply Chain to Explore the Future of Vehicle Electrification

HOTEL & TRAVEL INFORMATION



Strasbourg is the capital of Alsace, a historic region in northeastern France. Bordering Germany and Switzerland, it reflects a lively mix of those cultures. Edged by canals, Strasbourg is home to the famous district of Petite France, with its quaint streets and striking architecture. With its current cosmopolitan vibe, the city enjoys both a dynamic history and an eye toward the future.

Ponts Couverts *(pictured)*

At the entrance to Strasbourg's picturesque Petite France are three fortified bridges, built in the 1300s, part of the city's original line of defense.

CONFERENCE VENUE:

Strasbourg Convention + Exhibition Centre
Place de Bordeaux
67082 Strasbourg, France

HOST HOTEL:

Hilton Strasbourg
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Room rate includes daily breakfast

DISCOUNTED CUT-OFF DATE: December 28, 2018

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Includes access to Symposia or Conferences Only.Does not include access to Tutorials.

	4 DAYS	2 DAYS
Rate After 18 January	€2,349	€1,699

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Includes access to Tutorials only. Does not include access to Conferences or Symposia.

	1 TUTORIAL	2 TUTORIALS	3 TUTORIALS
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**Full-time graduate students including Masters, PhD candidates and post-docs are eligible for the student fellow rate. A poster is required. Posters must be presented during the Symposia and/or Conferences rograms. Tutorials do not have a poster program.*

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Student Fellow* Symposia & Conference	€499	€299

	1 TUTORIAL	2 TUTORIALS	3 TUTORIALS
Student Fellow* Tutorials add on	€99	€199	€299

PROGRAM SELECTIONS

Sunday 27 January	Monday 28 January	Tuesday 29 January	Wednesday 30 January	Thursday 31 January
INTERACTIVE TUTORIALS	R&D SYMPOSIA		APPLICATION CONFERENCES	
Tutorials: See page 5	CHEMISTRY		HYBRID & ELECTRIC VEHICLES	
	RAW MATERIALS			
	ENGINEERING		SPECIALTY/PUBLIC TRANSPORT EVs	
	LEAD-BASED			
	Dinner Tutorials: See page 5			

ONLINE REGISTRATION ENDS 25 JANUARY!

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Contact our Registration department at **781-972-5400** or Toll-free in the US **888-999-6288.**

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20% VAT will be added to each registration.

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If you do not receive your link within 5 business days, please contact **jring@cambridgeenertech.com.**
Students* presenting a poster can attend AABC Europe for as little as €299. The Student* poster rate is not eligible for €150 poster discount.

Ways to SAVE!

Group Discounts are Available! Special rates are available for multiple attendees from the same organization. For more information on group discounts contact **Joseph Verange at 781-247-6263.**

How to Register: **AdvancedAutoBat.com/Europe**

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"Must-attend conference if you are working on batteries for automotive electrification. It tells us always the latest and hottest topics, worldwide trends, and is **a good networking opportunity.**"

- Masato Origuchi, Renault

"This is a unique conference that brings together the industry experts for all kinds of automotive batteries, from 12-volt lead–acid to high-volt traction."

- Eckhard Karden, PhD, Ford Research & Advanced Engineering, Europe

"People show what will be the future, but it's also dealing with practical questions, it's not just a dream."

- Muriel Desaeger, PhD, Toyota Motor Europe

"The annual visit of AABC is a must for any developer or scientist working on battery technologies for automotive applications."

- Arnold Lamm, PhD, Daimler AG

"AABC is the event to get up to date with the state of automotive battery technology and meet the experts, suppliers and scientists.

A unique opportunity for learning and networking."

- Roland Matthé, Opel Automobile GmbH

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Please refer to the Registration Code below:

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