Click Here to Register Online!
SAVE up to €200, Register by 22 January!
AdvancedAutoBat.com

Announcing the 6th European

aabc europe

advanced automotive & industrial battery conference

SAVE up to €200 Register by 22 January!

25 - 28 January 2016
Congress Centrum Mainz
Mainz, Germany

Program Highlights:

- Latest Assessment of the xEV & xEV-Battery Market
- xEV Battery Technology Updates [Audi, Daimler, Porsche, Toyota & Volkswagen]
- 14V Architecture Expansion [PSA & Valeo]
- Batteries for 48V Systems [Audi & Hella]
- Thermal & Mechanical Pack Engineering Updates [Renault, Daimler & Valeo]
- Battery Safety Testing: Materials, Cells, Packs & In-Vehicle
- xEV Battery Charging – AC, DC, or Wireless
- The Latest in Advanced Electrolytes for Lithium-Ion
- Beyond Lithium-Ion – Challenges & Opportunities
- EC Capacitors – Advances in Conventional vs. Hybrid Systems
- Automotive Batteries in Industrial Applications
- Batteries for Light EVs with Insights from China & Europe

SIGNATURE SPONSOR: TOYOTA | KEYSTONE SPONSOR: Johnson Controls | PLATINUM SPONSORS: A123 SYSTEMS, Hitachi Chemical | GOLD SPONSOR: MACCOR | SILVER SPONSORS: AVL, Maxwell

AdvancedAutoBat.com

Click Here to Register Online!
SAVE up to €200, Register by 22 January!
AdvancedAutoBat.com

Welcome!

I am pleased to share with you some of the excitement about AABC Europe 2016, and invite you to join us in Mainz this coming January.

During most of the last decade, the development of advanced automotive batteries was focused on high-voltage hybrids; low-capacity, high-power batteries were required to replace NiMH technology in conventional 100-300V hybrid vehicles.

About five years ago, developing larger batteries to power plug-in hybrids took center stage. These batteries are now finding their way to the market, powering the large number of PHEVs that have been introduced this year, and the new ones to be released soon.

In the past 12-24 months, we have seen diversification at the opposite ends of the spectrum: EV batteries to power long-range EVs with capacities exceeding 80 kWh and in voltages up to 800V on the one hand, and low-voltage, low-capacity, high-power batteries ranging from 0.12 to 0.6 kWh, at 14 to 48V, to support micro- and mild-hybrids on the other.

While Lead-Acid batteries and supercapacitors are contenders for a low level of hybridization, Lithium-Ion chemistry is the dominant candidate for most applications. Yet, for each of them, some fundamental questions remain:

- What are the specific anode and cathode chemistries?
- What cell design?
- What pack design?
- Which supplier?
- At what cost?
- In what volume for each category?

These questions will be addressed at AABC Europe 2016, where chief battery technologists from major European automakers will present their development trends and projected battery needs, and their key suppliers will present their latest offerings and roadmaps for the future.

This is a pivotal time for the industry with production volumes starting to ramp up, while the battery designs of new programs are being completed and suppliers selected–**Join us and our new partners at Cambridge EnerTech in Mainz to start the year well-informed!**

Menahem Anderman, *Conference Chair*
Advanced Automotive Batteries Europe 2016

Top Reasons to Attend

- **Learn first-hand about the technical and business directions of European automakers from ten of the major automakers currently active in the European market**
- **Meet leading energy storage technologists from all automakers active in the European market**
- **Hear the latest updates on advances in electrochemical capacitor technology and application**
- **Learn about the newest advances in next-generation materials and cell technologies from some of the world's top battery materials experts**
- **Participate in frank discussions on battery safety validation**
- **Network with the largest 2016 international gathering of advanced energy storage technology developers and integrators in Europe**

Click Here to Register Online!
SAVE up to €200, Register by 22 January!
AdvancedAutoBat.com

Growing with Cambridge EnerTech

Phillips Kuhl, *President, Cambridge EnerTech*
For over 15 years, the Advanced Automotive Battery series of conferences has attracted professionals from the hybrid and electric vehicle world and their battery system suppliers, to stimulate the sharing of experiences and views at venues across Europe, the United States, and Japan.

Cambridge EnerTech unites these leading automotive battery events within a diverse portfolio of conferences spanning the entire energy storage landscape. Together with the International Battery Seminar, founded by Shep Wolsky, and the battery conferences from Knowledge Foundation, founded by Craig Wohlers, Cambridge EnerTech represents the definitive network of resources for the rechargeable battery market. We look forward to continuing our relationships with Menahem, Shep and Craig through their ongoing support and contributions to the development of all of the Cambridge EnerTech programs. The positive impact of this synergy has already been experienced at recent events.

Each year, AABC Europe brings together an international audience of automakers and energy storage system developers to discuss the key issues impacting the technology and market of advanced vehicles and the batteries that will power them in a unique European market, as well as on a global scale.

We are excited to share this year's agenda with you. As always, the core of the event is a strong technical program. The 2016 schedule will also feature ample opportunities to have dynamic discussions with technical poster presenters, meet with exhibitors to explore the latest developments, and network with speakers and other attendees.

We look forward to welcoming you to Mainz, Germany in January as a great way to start off 2016.

Cambridge EnerTech
Facilitating Advances in Rechargeables

Program Overview

	Monday, 25 January	
	SYMPOSIUM	**TUTORIALS**
	ELECTROCHEMICAL (EC) CAPACITORS SYMPOSIUM	**Battery Design and Performance Simulation (10:20 - 12:20)** **Beyond Lithium-Ion: Status and Perspectives (13:35 - 15:35)** **The Rechargeable Battery Market: Value Chain and Main Trends (16:15 - 18:15)**
10:00 - 12:20	**Advances in EC Capacitor Materials and Cell Design**	
12:20 - 13:45	Networking Lunch	
13:45 - 15:35	**New EC Capacitor Products**	
15:35 - 16:10	Refreshment Break	
16:10 - 18:15	**EC Capacitor Storage System Applications**	
18:15 - 19:15	Welcome Reception	
	Tuesday, 26 January	
	SYMPOSIA	
	LITHIUM BATTERY CHEMISTRY SYMPOSIUM	**BATTERY ENGINEERING SYMPOSIUM**
8:30 - 10:10	**Lithium-Ion Materials R & D**	**Energy Storage System Thermal Design and Durability**
10:10 - 11:00	Grand Opening Coffee Break with Exhibit & Poster Viewing	
11:00 - 12:40	**Lithium-Ion Industrial R & D**	**Energy Storage System Electrical Design and Management**
12:40 - 13:55	Networking Lunch	
13:55 - 14:40	Dessert Break with Exhibit & Poster Viewing	
14:40 - 16:45	**Beyond Lithium-Ion**	**Lithium-Ion Battery Safety and Abuse Tolerance**
16:45 - 17:45	Networking Reception with Exhibit & Poster Viewing *Sponsored by Johnson Controls*	
	Wednesday, 27 January	
	ADVANCED AUTOMOTIVE BATTERY TECHNOLOGY, APPLICATION & MARKET CONFERENCE	
	HIGH-VOLUME AUTOMOTIVE	**INDUSTRIAL AND SPECIALTY AUTOMOTIVE**
9:00 - 10:05	**SHARED SESSION: xEV and Industrial Battery Market**	
10:05 - 10:50	Coffee Break with Exhibit & Poster Viewing *Sponsored by Maxwell Technologies*	
10:50 - 12:45	**SHARED SESSION (Cont.): xEV and Industrial Battery Market**	
12:45 - 13:30	Networking Lunch *Sponsored by A123 Systems*	
13:30 - 14:15	Dessert Break with Exhibit & Poster Viewing	
14:15 - 15:40	**Energy Storage for Low-Voltage Hybrids**	**Light Electric Vehicles (LEVs) and Their Battery Systems**
15:40 - 16:30	Refreshment Break with Exhibit & Poster Viewing	
16:30 - 18:00	**Energy Storage for Low-Voltage Hybrids**	**Commercial xEVs and their Battery Systems**
18:00 - 19:30	Networking Reception with Exhibit & Poster Viewing *Sponsored by Toyota*	
	Thursday, 28 January	
	ADVANCED AUTOMOTIVE BATTERY TECHNOLOGY, APPLICATION & MARKET CONFERENCE (CONT.)	
	HIGH-VOLUME AUTOMOTIVE	**INDUSTRIAL AND SPECIALTY AUTOMOTIVE**
9:00 - 10:05	**High-Voltage xEV Battery Technology**	**Automotive Battery Technology for Industrial Energy Storage Applications**
10:05 - 10:50	Coffee Break with Exhibit & Poster Viewing *Sponsored by AVL, Inc.*	
10:50 - 12:15	**High-Voltage xEV Battery Technology (Cont.)**	**Automotive Battery Technology for Industrial Energy Storage Applications (Cont.)**
12:15 - 13:00	Networking Lunch *Sponsored by Hitachi Chemical*	
13:00 - 14:00	Dessert Break with Exhibit & Poster Viewing	
14:00 - 16:50	**SHARED SESSION: Battery Charging, Transportation and Recycling/Reuse**	
16:50	End of Conference	

Tutorials

10:20 – 12:20
Battery Simulation
Battery Design and Performance Simulation

Presented by: **Bob Spotnitz**, *President, Battery Design LLC*

Dr. Spotnitz is a leading developer of mathematical models that simulate battery operation. Dr. Spotnitz, who previously held several senior technical positions in materials and battery development, founded Battery Design in 1999 to provide consulting and develop custom software for battery developers and users. He is a well-known speaker on various aspects of battery engineering.

OUTLINE

- Overview of Battery Modeling
- Cell Sizing
- Overview of Battery Simulation Models
- Simulation of Ageing
- Simulation of Abuse

13:35 – 15:35
Beyond Lithium-Ion
Beyond Lithium-Ion: Status and Perspectives

Presented by: **Martin Winter,** *Chair, Applied Materials Science for Electrochemical Energy Storage and Conversion, Institute of Physical Chemistry (IPC) - Founding Scientific Director, MEET Battery Research Center, WWU Münster - Founding Director, Helmholtz Institute "Ionics in Energy Storage"*

Prof. Winter's interests are in applied electrochemistry and electrochemical materials science. He has been active in the field of battery science and technology for more than 20 years.

For his achievements, he was awarded with the Research and Technology Awards of the Electrochemical Society (ECS) and the International Battery Materials Association (IBA), respectively, and with the Carl Wagner Memorial Award of the ECS. He is a Fellow of the ECS and the International Society of Electrochemistry (ISE).

Currently, he is the chairman of the advisory board of the Batterieforum of the BMBF (Germany Ministry of Education and Research) and a member of the German National Platform E-Mobility (NPE).

OUTLINE

- Definitions: Beyond-lithium-ion, before-lithium-ion and parallel-to-lithium-ion
- A long journey: From Li metal to lithium-ion batteries and back again
- The anode makes the difference
- Metal sulfur technology
- Metal air technology
- High energy and high voltage lithium-ion technologies
- Technology monopoly or technology diversity?

16:15 – 18:15
Battery Market
The Rechargeable Battery Market: Value Chain and Main Trends 2015 - 2025

Presented by: **Christophe Pillot**, *Battery Survey Manager, Avicenne Energy*

Christophe has built up considerable expertise in the area of battery market. He joined Avicenne 18 years ago and spent 3 years in Japan analyzing the Japanese Electronic, Mobile & Battery market. Christophe has acquired extensive experience in marketing, strategy analysis, technology and financial studies for the battery and power management fields. He developed the battery market analysis for Avicenne, which serves more than 180 customers worldwide. Christophe has published several annual surveys such as "The rechargeable battery market 2012-2025". Globally, he has been involved in more than 200 projects for 100+ customers in the battery value chain. Before joining Avicenne, Mr. Pillot held a key position in France Telecom's innovation division. He has a degree in Chemistry and a MBA in Innovation management from Pays IX Dauphine.

OUTLINE

- The Rechargeable Battery Market in 2015
- Li-ion Battery Value Chain (Anode, Cathode, Electrolyte, Separators)
- xEV Market in 2015 and Forecasts Up to 2025
- Advanced Energy Storage for Grid Systems & Renewable Energy
- Could Lithium-Ion Replace Lead Acid?
- Rechargeable Battery Market Forecasts Up to 2025

Poster Submissions

Present your latest R&D findings to 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. Accepted poster presenters also receive a €150 discount off their registration fee. We are particularly interested in posters covering the following topics:

- Large Lithium-Ion Battery Technology
- Electrochemical Capacitor Technology and Applications
- Energy Storage for xEVs
- Advanced Batteries beyond Li-Ion

The deadline to submit your poster abstract is **7 December 2015**

See website or email **posters@advancedautobat.com** for more information

Electrochemical (EC) Capacitors Symposium

MONDAY 25 JANUARY 2016

8:30 - 18:30 Registration

Session 1: Advances in EC Capacitor Materials and Cell Design

This session will explore the latest advances in materials—including the development of advanced materials and processes to meet the pricing threshold of important markets—and in capacitor design—including the development of advanced asymmetric ECs.

> "Complete overview, from material to system."
>
> ***- Frank Moebius, BMW AG***

10:00 - 10:05 Chairperson's Opening Remarks

Prof. Katsuhiko Naoi, Professor of Chemistry, Institute of Symbiotic Science & Technology, Tokyo University of Agriculture & Technology

10:05 - 10:25 New Insights on Generation-II Supercapacitors

Prof. Katsuhiko Naoi, Professor of Chemistry, Institute of Symbiotic Science & Technology, Tokyo University of Agriculture & Technology

Practical research and developments are now being vigorously conducted to improve the energy density of EDLCs. Soon, we will witness the generation-II or high energy density supercapacitors. The appearance of LIC (lithium ion capacitor) and NHC (nanohybrid capacitor) is certainly regarded as the beginning of an age of improved energy densities in the field of supercapacitors. In the future, other hybrid supercapacitor systems may have the potential to show further enhancements to develop the field of practical supercapacitor devices. The present talk deals with the new insights on ultrafast nanomaterials processed by ultracentrifugation for generateon-II capacitors and PPBS namely Prominence Power Battery System.

10:25 - 10:45 Tracking Ion Fluxes in Porous Carbon Electrodes Used in Double Layer Capacitors

Prof. Patrice Simon, Professor of Material Science, Université Paul Sabatier

This talk will firstly present results about the experimental study of the ion confinement effect on the electrochemical characterizations of microporous carbons. By using Electrochemical Quartz Crystal Micro-balance (EQCM) coupled with in-situ NMR, we will show how the ions and the solvent molecules organize themselves in the carbon pores during the charge and the discharge of EDLCs. These results provide a direct molecular-level insight into the charge storage process in microporous carbon electrodes, and show that the charging mechanisms differ depending on the polarization of the electrode surface. The methodology introduced here opens the way for the study of factors such as relative pore/ion sizes, concentration and solvent effects on the ionic composition of the electric double-layer during charging, questions that are at the heart of current efforts to optimize and improve the energy storage capabilities of supercapacitors.Different behaviors were observed depending on the polarity of the electrodes.

10:45 - 11:05 Novel Concepts of High Energy Electrochemical Capacitors

Prof. Elżbieta Frąckowiak, Professor, Poznan University of Technology

Different types of aqueous electrolytes with a redox activity based on iodine, bromine, sulfur have been used for capacitance enhancement. For the voltage extension, combinations of electrode/electrolyte interfaces with various pH and composition for both negative and positive electrodes were proposed. The detailed electrical examination of such capacitors (by galvanostatic charge/discharge, cyclic voltammetry, electrochemical impedance spectroscopy, floating etc.) confirmed a good cycling, perfect charge dynamics as well as beneficial energy and power values. The capacitor characteristics obtained in aqueous electrolytes can be comparable to the parameters obtained in organic medium.

11:05 - 11:25 Revisiting the Concept of Activated Carbon/Ni(OH)2 Hybrid Capacitors

Prof. Thierry Brousse, Professor of Materials Science, Institut des Matériaux Jean Rouxel (IMN), Université Polytechnique Nantes

For more than two decades hybrid capacitors based on aqueous electrolytes have attracted much attention mainly due to the simplicity of the concept. Most of the research efforts and R&D developments have been dedicated to the activated carbon/KOH/Ni(OH)2 device that has demonstrated very high energy density compared to standard carbon based electrochemical capacitors. On one hand these advances targeted more specifically the improvement of rate capability of the positive electrode which was identified as the kinetically limiting element of the device. On another hand not so much work has been performed aiming at the improvement of energy density which is mostly limited by the negative carbon electrode. Our recent works on functionalized carbons have open new pathways toward the enhancement of capacity (mAh/g) of carbon based electrode. Thus we have applied this strategy to a carbon based negative electrode functionalized with quinone moieties that has been implemented in a carbon/KOH/Ni(OH)2 device and compared to a standard design. Energy density has been drastically improved when functionalized carbon was used without affecting rate capability. Long term cycling efficiency has also been studied and the results will be detailed in this communication.

11:25 - 11:45 Highly Effective Materials for Sacrificial Pre-Lithiation of the Graphitic Anode in Li-Ion Capacitors

Prof. François Béguin, Professor, Poznan University of Technology

Among the various electrochemical capacitors, the lithium ion capacitor displays the highest energy density owing to the use of a negative graphite intercalation electrode. The commercially available systems implement an auxiliary lithium electrode for graphite pre-lithiation. This presentation deals with the optimization of a new concept based on a composite positive electrode constituted of high surface area activated carbon and lithiated materials from which lithium is irreversibly extracted to form the graphite intercalation compound. Both oxides

Electrochemical (EC) Capacitors Symposium

and organic lithiated materials have been used with the objective of increasing the amount of irreversible lithium and thereby of reducing the dead mass introduced in the positive electrode.

11:45 - 12:05 Toward New Electrolytes for Electrochemical Double Layer Capacitors

Dr. Andrea Balducci, Researcher, Helmholtz Institute Ulm

In this presentation the development of innovative conducting salts for EDLCs will be discussed. Furthermore, also the use of computational screening for the identification of innovative solvents for EDLCs will be considered. Particular attention will be dedicated to the following aspects: 1). Influence of the selection on ions on the performance of high voltage EDLCs containing ionic liquids as electrolytes. 2). Influence of innovative electrolyte on the chemical stability of inactive components, e.g. Al current collectors. 3). Advantage and limits related to the use of computational screening for the identification of new electrolytes. The presentation will conclude with a summary and discussion about the next steps necessary for the optimization of high voltage EDLCs containing alternative electrolytes.

12:05 - 12:20 Q&A

12:20 - 13:45 Networking LUNCH

Session 2: New EC Capacitor Products

This session will review new capacitor products and EC business development activity. Leaders from key companies will discuss present and future products and business development strategies as they expand their product offerings to support the growth of energy-efficient industrial, utility, and transportation-related energy-storage systems.

13:45 - 13:50 Chairperson's Opening Remarks

Michael Everett, CTO, Maxwell Technologies

13:50 - 14:10 Development of Carbon Material for Higher Voltage EC Capacitors

Udaya Kumara, Director, R&D, Haycarb, PLC

Activated carbon is the key component for EDLC. Physical and chemical characteristics of activated carbon governs the initial capacitance, ESR and life performance of electrodes and cells made from activated carbon. When compared with Haycarb coconut shell based activated carbon grades HCE 202 and HCE 201 currently used in 2.7V 3000F super capacitors. Our new product developed is a promising candidate for 3V and above applications.

14:10 - 14:30 Ionic Liquid-Based Supercapacitors –Targets and Limitations

Dr. Svetlana Menkin Bachbut, Researcher, Energy & Power Group, Elbit Systems

In the last few years, much effort has been dedicated to the development of electrolytes, allowing the realization of high voltage EDLCs (>3 V). Among the electrolytes proposed so far, those based on ionic liquids (ILs) are considered the most promising. Symmetric activated-carbon-based super-capacitors cells comprising ionic liquid electrolyte were studied. Energy density of 32Wh/kg and power density of 14kW/kg were achieved in symmetric lab scale EDLC. However, in the process of the product development several issues such as practical cycle life as function of the maximum voltage, type of activated carbon and the cost of the materials should be addressed.

> "AABC is the most important conference for the Renault Battery Team."
>
> ***- Masato Origuchi, Renault***

14:30 - 14:50 Keeping the Ultracapacitor Industry Competitive

Dr. Renee Joost, Program Director, Skeleton Technologies GmbH

The ultracapacitor industry is still an emerging market, yet with significant growth over the past decade. At the same time we have only seen 10% increase in voltage and capacitance from the leading market players. One of the key challenges for the industry is how to power additional growth in a situation where improvements in lithium titanate and other technologies are expanding their territory in the high power/ fast-response niche of the energy storage sector. In order to create a healthy multi-billion dollar market ultracapacitor industry needs to reclaim it´s territory. Skeleton Technologies is at the forefront of this effort by introducing the SkelCap product family, which represents the largest single performance advancement during the past decade.

14:50 - 15:05 Q&A

15:05 - 15:35 Sponsored Presentation

15:35 - 16:10 Refreshment BREAK

Session 3: EC Capacitor Storage System Applications

This session will review EC module design and system engineering, including those related to transportation, to industrial energy conservation, and to the utility grid.

16:10 - 16:15 Chairperson's Opening Remarks

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

16:15 - 16:35 High Energy Density Supercapacitors

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

Several approaches to increasing the energy density of supercapacitors are considered and evaluated based on calculations and available materials and cell

Electrochemical (EC) Capacitors Symposium

data. By high energy density is meant values approaching that of lead-acid and lithium batteries. It appears that lead-acid energy densities can be achieved in hybrid electrochemical capacitors using lithium or LTO in the negative electrode combined with graphite and/or carbon. Energy densities approaching those of lithium batteries can be achieved in high voltage (1000-2000V) dielectric devices using high permittivity (>5000), nano-composite polymer materials. Test data will be presented for the dielectric materials and for lithium-doped hybrid cells.

16:35 - 16:55 Ultracapacitor Modules that Produce the Highest Power and Efficiency

Dr. Yurii Maletin, Chief Scientist, Yunasko

Yunasko has recently developed a proprietary UC design that enables to assemble modules from 12 V to 112 V wherein from 4 to 42 UC cells are connected in series. The modules demonstrate superior performance as compared with any competing devices as to their power capability and efficiency. The current Yunasko R&D portfolio also includes the following perspective directions: 1). Hybrid Li-ion capacitors (LIC) of enhanced energy density – up to 37 Wh/kg 2). UC devices for high temperature applications – up to 100 °C 3). Proprietary highly productive dry electrode manufacture technology.

16:55 - 17:15 EC Capacitors for Stabilizing Utility Grids with High Renewable Penetration

Dr. Norbert Hennchen, Chief Executive Officer, Freqcon

Integrating high levels of renewable energy without compromising grid stability is a serious challenge for grid operators. EC capacitors in combination with fast-acting power electronics can play a significant role in supplying frequency support services to the grid. This talk will present practical applications in Ireland, a country with 40% renewable target for 2020.

17:15 - 17:35 Lithium Titanate Oxide (LTO) Batteries and Supercapacitors as an Option for Hybrid Vehicles

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

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

17:35 - 17:55 Combining Energy with Power: Lithium Ion Capacitors

Benoit Lalande, Senior Application Engineer, JSR Micro

The Lithium Ion Capacitor is an innovative energy storage technology which made its entry into the energy storage markets more than five years ago. In the meantime, it has evolved into an ideal commercialized solution for closing the application gap between Lithium Ion Batteries and Supercapacitors. Combining energy and power with long-lasting life characteristics, lithium ion capacitors are already used today in hybrid buses, trams, hybrid excavators, medical equipment and power quality equipments amongst other applications. Further technology development and high volume production will allow mass deployment of lithium ion capacitors in the energy storage market in the following years. This presentation will explain how ULTIMO Lithium Ion Capacitors combine Energy with Power by discussing: 1). The concept of the Lithium Ion Capacitor technology and its positioning on the Ragone plot 2). How Lithium Ion Capacitors can bridge the gap between Lithium Ion Batteries and Supercapacitors, in particular by looking at similarities and differences in electrical performances 3). Commercial usage cases in different industrial applications, mobile as well as stationary 4). JSR Group High Volume Manufacturing plans 5). A vision on the future of Lithium Ion Capacitors

17:55 - 18:15 Q&A

18:15 - 19:15 Welcome Reception

Lithium Battery Chemistry Symposium

TUESDAY 26 JANUARY 2016

7:30 - 19:00 Registration

Session 1: Lithium-Ion Materials R&D

In this session, leading materials R&D professionals will review the prospects of advanced cathodes, anodes, and electrolytes to deliver better performance, life, and safety, at equal or lower cost than current chemistries, and to provide enhanced value for large Li-Ion batteries.

8:30 - 8:35 Chairperson's Opening Remarks

Prof. Martin Winter, Chair, Applied Materials Science for Electrochemical Energy Storage and Conversion, Institute of Physical Chemistry (IPC) - Founding Scientific Director, MEET Battery Research Center, WWU Münster - Founding Director, Helmholtz Institute "Ionics in Energy Storage"

8:35 - 8:55 SEI: Yesterday, Today, and Tomorrow

Prof. Emanuel Peled, Emeritus Professor, School of Chemistry, Tel Aviv University

The Solid-Electrolyte-Interphase (SEI) model for nonaqueous alkali-metal batteries constitutes a paradigm change in the understanding of lithium batteries and has thus enabled the development of safer, durable, higher-power and lower-cost lithium batteries for portable and EV applications. Prior to the publication of the SEI model (1979), researchers used the Butler-Volmer equation, in which a direct electron transfer from the electrode to lithium cations in the solution is assumed. The SEI model proved that this is a mistaken concept and that, in practice, the transfer of electrons from the electrode to the solution in a lithium battery, must be prevented. It provides new equations for: electrode kinetics (io and b), anode corrosion, SEI resistivity and growth and irreversible capacity loss of lithium ion batteries. This presentation will discuss the necessity, the properties, the degradation, the growth rate and the potential improvements of the SEI for several types of anodes.

These issues include:

- Is it possible to develop a SEI free lithium metal or lithium ion anode?
- What are the differences between the SEI and a common redox electrode?
- What parameters affect the SEI composition, properties, ageing phenomena and safety related issues?
- What are the reasons for lithium dendrite formation on charge?
- Can we eliminate or reduce the lithium dendrite formation problem?
- Does SEI growth limits the cycle life of silicon nano particle and silicon nano wires anodes?
- Efforts to develop an improved SEI and an artificial SEI on lithium, graphite and silicon.

8:55 - 9:15 Electrolyte Additive Decomposition and Anodic Stability of Conductive Carbons in Lithium-Ion Batteries Examined by On-Line Electrochemical Mass Spectrometry (OEMS)

Dr. Hubert Gasteiger, Chair, Technical Electrochemistry, Technical University of Munich

Increasing cycle-life and energy density of lithium ion batteries requires the development of improved electrolyte additives and a detailed understanding of the stability of electrolyte and cathode electrode components, particularly at high anodic potentials. A useful tool to examine fundamental decomposition/degradation mechanisms is on-line electrochemical mass spectrometry (OEMS). In this presentation, we will discuss the following aspects:

- Anodic and cathodic decomposition mechanisms of commonly used additives and co-solvents
- Quantification of the anodic stability of conductive carbons and of conductive carbon coatings at potentials relevant for high-voltage cathode materials
- Effect of water impurities on carbon oxidation rates and on electrolyte stability

> "AABC Europe is the best networking event every year."
> ***- Uwe Wiedemann, AVL***

9:15 - 9:35 Tailoring of Material Morphology for Improving the Electrochemical Performance of Cathode Materials for Lithium-Ion Batteries

Jie Li, Group leader, MEET Battery Research Center, Muenster University

Particle morphologies of active materials, including shape, size, type of agglomeration and surface properties, play an important role in the electrochemical battery performance. We have devolved several morphologies for various cathode materials by choosing different synthesis approaches and controlling the synthesis conditions. In this presentation, we will address two different materials as illustrative examples, i.e. the Li-rich layered material and the Li-Ni-Mn-O high-voltage spinel material.

Li-rich layered material:

- How to prepare hollow spherical and 3D porous Li-rich layered materials?
- How to decrease the extent of agglomeration of the secondary particles?
- How does the morphology affect the electrochemical performance, in cycling stability, rate capability and voltage decay?

Li-Ni-Mn-O high-voltage spinel material:

- Is it necessary to go for nano for LNMO material?
- Are {100} surfaces positive for the stability of LNMO material?
- Is the LNMO material compatible with elevated temperature applications?
- Is it possible to get power capability and cycle life simultaneously?

9:35 - 9:55 Novel Li-Ion Battery Electrolyte Materials: What Can We Envisage for the Future?

Dr. Patrick Johansson, Professor, Chalmers University

Novel electrolyte materials is the basic starting point to attack the practical disadvantages that we often face at the cell level – safety, degradation, life-length,

Lithium Battery Chemistry Symposium

cost, etc. Fundamentally, a modern functional Li-ion battery electrolyte needs to provide a large set of properties, including:

- A large amount of highly mobile charge carriers
- Chemical and electrochemical stability incl. electrode compatibility
- Safety – low flammability, non-toxicity, etc.

In this presentation a bottom-up academic research based approach will be used moving from predictive computational approaches via proper physical characterisation of model systems up to monitoring resulting safety properties of the electrolytes. Topics covered in more detail include:

- Design of novel anions to replace PF6-, including fluorine-free anions
- Methodologies for fast screening of electrolyte material properties
- Methodologies for assessing the origin of degradation reactions in detail

Finally a summary of various current trends for Li-ion battery electrolytes is made with a perspective of not only high-lighting large promises, but also the obstacles remaining and how the topics above might be useful as problem solvers.

9:55 - 10:10 Q&A

10:10 - 11:00 Grand Opening Coffee Break with Exhibit & Poster Viewing

Session 2: Lithium-Ion Industrial R&D

In this session, materials and electrode-processing vendors will discuss advances in active and inactive materials and electrode-manufacturing technology.

11:00 - 11:05 Chairperson's Opening Remarks

Prof. Martin Winter, Chair, Applied Materials Science for Electrochemical Energy Storage and Conversion, Institute of Physical Chemistry (IPC) - Founding Scientific Director, MEET Battery Research Center, WWU Münster - Founding Director, Helmholtz Institute "Ionics in Energy Storage"

11:05 - 11:25 Designing Cathode Materials for Next Generation Electric Vehicles

Dr. Christoph Erk, Research Scientist, Lithium-ion Batteries Cathode Materials, BASF

11:25 - 11:45 Present and Future Development of Battery Materials at FMC

Marina Yakovleva, Commercial Manager, New Product and Technology Development, FMC Corporation

FMC is one of the world's leading suppliers of high value Lithium products and is a leading supplier to the Electric Storage market. FMC's products have been used by the Li-ion industry since its inception. FMC continues its focus on customer applications and emerging technologies through its R&D efforts in developing new products and technologies that can meet the demand for higher energy density systems. The company is well recognized in industry for its past innovation of the advanced cathode materials and its revolutionary SLMP® Technology that paves the way to enhancing energy density of the Li-ion batteries and enables the beyond Li-ion applications, such as lithium metal batteries and lithium ion capacitors. This presentation will review:

> "There is nothing to improve. AABC Europe is excellent."
> ***- Tomohiko Ikeya, Central Research Institute of Electric Power Industry***

- FMC's outlook on the rechargeable Li-ion market from the supplier prospective
- The role of lithium precursors in the development of the advanced cathode materials
- Opportunities for the advancements of the Li-ion and beyond Li-ion systems

11:45 - 12:05 Presentation to be Announced

12:05 - 12:25 Evaluation of Materials and Concepts for Future Automotive xEV Batteries

Dr. Peter Lamp, Head, Research Battery Technology, BMW Group

New mobility concepts are required to balance the individual need for mobility and the sustainable utilization of natural resources as well as the protection of the environment. Technology improvements are necessary that allow the transition towards mobility concepts based on renewable energies. Today the electrification of drive trains, ranging from hybrid vehicles to plug-in hybrids, and finally to pure electric vehicles, is the commonly accepted next step in this direction. BMW is strongly committed to this path. The electric energy storage is the key technology for electrification. Energy and/or power density of the storage system define the fuel reduction potential as well as the customer acceptance. In the last decades, the introduction of electric vehicles failed due to the lack of a suitable electric energy storage technology able to fulfill the automotive requirements. The introduction of Li-ion technology in the consumer market re-stimulated the development of electrified vehicles. To make it a success story, care has to be taken to fulfill the present and future customer expectations, in particular with regard to safety and reliability, performance and costs. One of the major factors for a high market penetration of electric vehicles is the ratio between driving range and costs. More than 90% of the world wide vehicle market falls in the price range below 50.000$; on the other hand, a driving range above 400 km is needed. That requires energy density targets above 250 Wh/kg or 400 Wh/l for a battery pack, with costs as low as 150 $/kWh. Different strategies are nowadays considered which enable a considerable increase in the electric range. These include the optimization of cell and electrode design, the introduction of novel cathode and anode materials for Li-ion cells, as well as the shift to alternative Post-Lithium-Ion technologies. Nevertheless, the impact of all these new approaches on lifetime and ageing still represents a critical issue. Considerable improvements must be obtained in this respect before a possible industrialization of the new generations of batteries for automotive application can be envisaged. This presentation will outline general design and subsequent development strategies

from a car manufacturer point of view. In particular it will address open issues to be solved in the future development of electric energy storage technologies for automotive applications.

12:25 - 12:40 Q&A

12:40 - 13:55 Networking LUNCH

13:55 - 14:40 Dessert Break with Exhibit & Poster Viewing

Session 3: Beyond Lithium Ion

In this session, we will explore prospects and challenges for futuristic rechargeable-battery chemistries, which are theoretically capable of providing higher energy densities and/or lower cost than Lithium-Ion chemistries.

14:40 - 14:45 Chairperson's Opening Remarks

Klaus Brandt, Independent Consultant

14:45 - 15:05 Overview of Rechargeable Li Batteries Before LIB

Dr. Klaus Brandt, Independent Consultant

Before Li-Ion batteries were commercialized in 1990, a significant effort was directed towards rechargeable Li Batteries with Li-metal anodes, culminating in the use of a significant number of Li-MoS2 batteries in laptops and cell phones in the late 1980ties. A variety of cathode chemistries were investigated, including transition metal sulfides like TiS2 and MoS2 and oxides like V2O5 and MnO2. In addition to liquid organic electrolytes, solid PEO-based polymer electrolytes were proposed, however, were not used due to their low room temperature conductivity. The limitation for the cycle life of these cells was the Li metal anode and its propensity to form dendritic deposits on charging, which not only shortened life but also posed a safety problem through the formation of internal shorts. However, through a number of measures at the cell level, a life of several hundred cycles was achieved. As an alternative to the Li-metal anode/liquid electrolyte system, Li-metal/solid electrolyte and Li-alloy/liquid electrolyte systems were investigated. Some of these technologies were used in rechargeable coin cells. As Li-metal anodes are again a research topic due to their high theoretical capacity per volume and especially per weight, we will discuss the measures taken in the past to improve the morphology of the cycled Li-anode deposit and with it cycle life in some detail. We will also show some recent work on this topic.

15:05 - 15:25 "Solidifying" Batteries – Solid Electrolytes in Lithium (Ion) Batteries

Dr. Jürgen Janek, Director, Materials Research Laboratory (LaMa), Scientific Director, Institute of Physical Chemistry, Justus-Liebig-University Giessen & BELLA, Institute of Nanotechnology, Karlsruhe Institute of Technology

Solid electrolytes and solid state batteries are currently attracting serious interest as potential future components and storage devices. Solid electrolytes (polymer, ceramic or composites) are required to construct protected lithium anodes – in case that lithium metal anodes will become again part of lithium batteries. If the cathode is still employed in contact with a liquid electrolyte, a new interface between a liquid and a solid electrolyte forms which can be highly resistive. Solid state batteries without any liquid electrolytes are considered as ultimately stable and safe devices, but are expected to suffer from poor kinetics and high costs. The lecture will include answers to the following questions:

- Are solid electrolytes necessarily worse lithium ion conductors than liquid electrolytes?
- Are solid electrolytes the key to ultimately long-term stable batteries?
- What do we know about the interface between liquid and solid electrolytes?
- What is the state of the art thin film battery?
- How to construct "thick film" solid state batteries?
- Important research tasks in the development of solid state batteries?

15:25 - 15:45 Room-Temperature Sodium Batteries – Craze or Opportunity?

Prof. Philipp Adelhelm Professor, Institute for Technical Chemistry and Environmental Chemistry, Center for Energy and Environmental Chemistry (CEEC), Jena University

Battery research is currently characterized by intense efforts to improve lithium-ion batteries (LIBs). On the other hand, batteries based on other elements are being studied as potential alternatives. The abundance of sodium is the main driving force to study sodium-based batteries with the aim of obtaining low-cost battery cell concepts and/or to overcome challenges known from next-generation lithium-ion systems such as lithium-air or lithium-sulfur. This presentation will summarize and discuss different aspects of sodium batteries.

- What is the present status of sodium-ion batteries (NIBs)?
- Can lithium be simply replaced by sodium in battery concepts?
- What happens when replacing lithium by sodium?
- Do sodium batteries work better or worse than lithium batteries?
- Can sodium batteries be cheaper than lithium batteries?

15:45 - 16:05 Development of Full Cell Chemistries for Magnesium Batteries

Dr. Anthony Burrell, Department Head, Electrochemical Energy Storage, Argonne National Laboratory

The continued development of high energy density, rechargeable batteries is an important area of need for the future advancement of energy storage systems. Although lithium-ion batteries (LIBs) are widely used for energy storage in many consumer electronic applications, issues associated with manufacturing a cost-competitive battery of sufficient energy density have slowed their development for large volume application such as electric vehicles or large scale stationary applications. While advantages of Mg batteries have been recognized for a long time, research is still at a very early stage, with many challenges ahead. Even though the Grignard or halogen-containing electrolyte systems works well with a Mg metal anode, at least in terms of cycling efficiency, and are compatible with a Chevrel phase cathode (1.1 V vs Mg), major issues exist in extending this to other cathodes. The development of electrolytes that have better overall performance is a major issue in advancing the science of a full Mg cell. Coupled with this is the need for a high voltage, high capacity cathode material. The complication of simultaneous electrolyte development coupled with cathode discovery have limited the overall progress. In this presentation we will discuss the concurrent discovery of an electrolyte system based upon Mg(TFSI)2 and its role in the development of a clear understanding of Mg intercalation chemistry in metal

Lithium Battery Chemistry Symposium

oxide hosts. A specific example orthorhombic V2O5 cathode (2.56 V vs. Mg) has complex intercalation behavior and serves has an excellent example of the path toward the high voltage Mg battery.

16:05 - 16:25 Zinc-Air: The Oldest Innovative Battery

Prof. Hajime Arai, Professor, Office of Society-Academia Collaboration for Innovation, Kyoto University

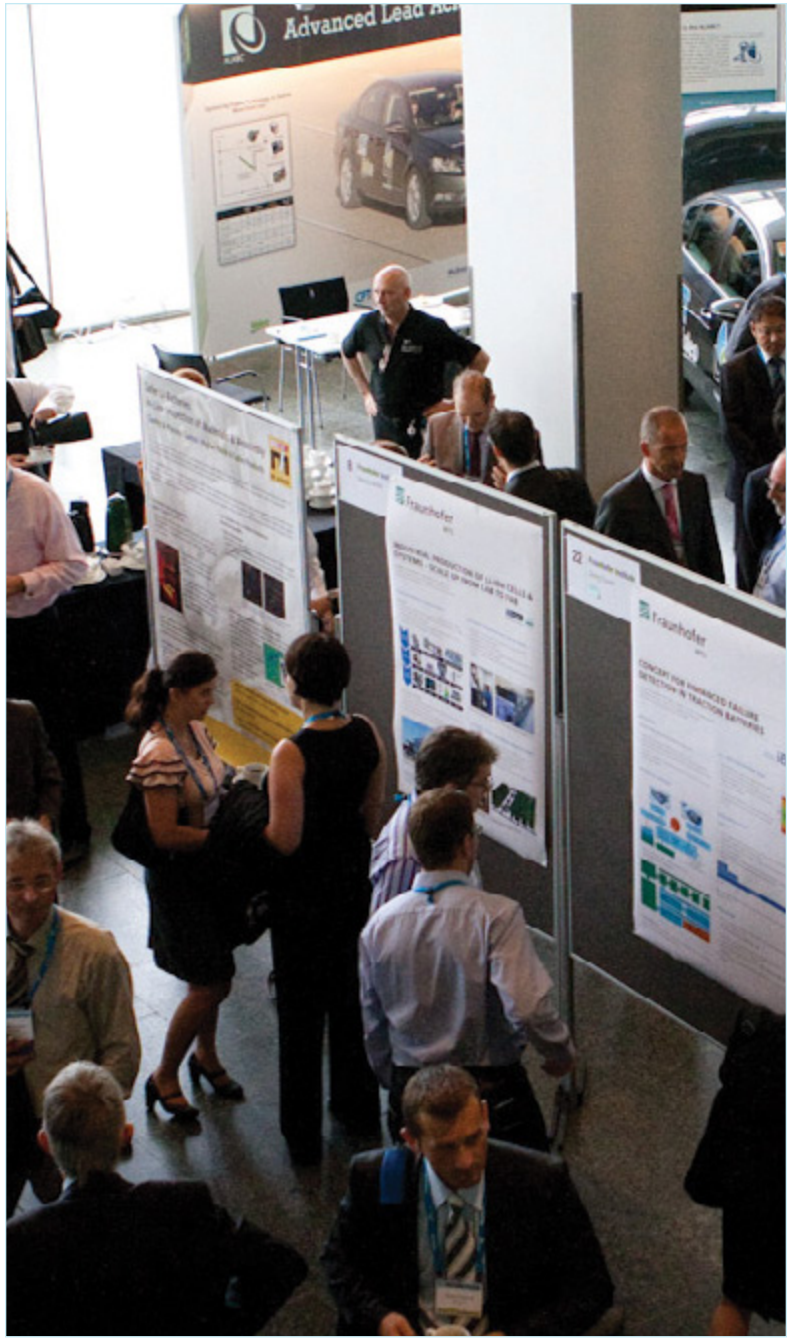
Zinc-Air batteries have been important candidates as power sources for electric vehicles for more than 40 years, and are still attractive as innovative "beyond Li-ion" batteries. The advantages include their high volumetric energy density (capable of 500 km driving per charge), high safety (as aqueous system) and low cost, whereas they generally suffer from limited lifetime and low efficiency. This presentation will discuss the following key issues:

- Comparison with Li/Air
- Electrical rechargeable or mechanical rechargeable
- Suppression of zinc dendrite formation and shape changes
- Trials to improve the activity and stability of air electrodes
- Auxiliaries to control air supply and cells
- Further challenges

16:25 - 16:45 Q&A

16:45 - 17:45 Networking Reception with Exhibit & Poster Viewing

Sponsored by Johnson Controls



Battery Engineering Symposium

TUESDAY 26 JANUARY 2016

7:30 - 19:00 Registration

Session 1: Energy Storage System Thermal Design and Durability

Energy-storage pack design and integration present thermal engineering challenges almost independent of cell chemistry. In this session, thermal components and system developers and suppliers will discuss advances in battery-pack thermal design.

8:30 - 8:35 Chairperson's Opening Remarks
Masato Origuchi, EV Battery Development Group Leader, Renault

8:35 - 8:55 New Challenges for Increasing EV Range
Dr. Julien Marie, EV Battery Development Technical Leader, Renault
Increasing the battery capacity for extending the driving range of EV is the key for ramping up the EV market volume after the launch of the first generation EVs. The drastic increase in usable energy of the battery requires technical breakthrough not only in the cell chemistry itself but in the integration of such battery in the vehicle packaging.

This presentation will illustrate the new challenges in EV battery development when increasing the driving range, as listed below:

- Key dimensioning parameters of higher capacity cell and module
- The possible evolution of the customer usage: mileage, type of driving, charging speed, SOC range
- Packaging and thermal constraints
- Trade-off between cycle durability and energy density

8:55 - 9:15 Design- and Integration-Process of HV-Batteries in Passenger Cars
Christian Brommer, Manager, Cluster Mechanical Engineering, Deutsche ACCUmotive
Alfred Jeckel, Manager, HV Battery Design/Testing, Daimler AG
The electrification of vehicle powertrain is an ongoing trend in the automotive industry. To reduce development time and to design an optimum product, a close collaboration between car manufacturer and battery manufacturer is necessary. In recent projects, the teamwork of Daimler and Deutsche ACCUmotive was an important base for a successful product development. This presentation will show the design and integration process of HV-Batteries for Mercedes-Benz and smart vehicles.

- Specification of Battery Requirements derived from vehicle demands (location, performance, assembly, multiple use)
- Specification of Interfaces (cooling, mechanical interfaces, electrical connection, venting)

A-sample
- Battery concepts: comparison of several battery concepts and built-up of the most promising concepts
- Common decision for concept (safety, reliability, costs, weight, range)
- Subcomponent design and specification (Cell, E/E, cooling, housing), first model for simulation of thermal and performance behavior

B-sample
- Testing on test bench (mechanical, thermal, lifetime) and first implementation into vehicle (software integration, EMC, cooling integration)
- Improvement due to test results, preparation of series production

C-sample
- (summer- / winter-test; crash; performance) Test-batteries with over 200 sensors for optimization of range of use

D-sample
- Production range up in battery plant and vehicle plant

> "Very good selection of topics and speakers. ***The*** place to meet the key people of the battery world."
>
> ***- Roland Matthe, Adam Opel AG***

9:15 - 9:35 Battery Thermal Management
Patrick Ancenay, Product Line Director, Battery Thermal Management, Valeo
Vehicle electrification is an increasing trend, and chemistry is delivering more and more power and energy density; consequently, thermal need becomes bigger. This is placing the battery thermal management as a key system, but that can not be considered as "stand alone" anymore, but needs to be integrated within a complete system approach, at the vehicle level, in order to bring the best efficiency to the vehicle need. This presentation intends to show different technologies to maintain Li-Ion batteries within the optimum range of temperature, but as well different possible system architectures.

9:35 - 9:55 xEV Battery System & Subsystem Review
Kevin Konecky, Battery Systems Consultant, Total Battery Consulting
Lithium-Ion battery systems are an enabling technology in the propagation of xEV's (Hybrid-Electric Vehicles, Plug-in Hybrid-Electric Vehicles and Electric Vehicles). Battery systems are a complex system integrating multiple subsystems including battery cells/modules, mechanical, thermal, BMS hardware & BMS software subsystems. This presentation will take a look at a large number of xEV's currently in production and discuss trends and diversity in the subsystem design choices that were implemented in each production system. Two important aspects of the battery system are safety and cost. Impacts of subsystem design on these two areas will also be discussed.

9:55 - 10:10 Q&A

Battery Engineering Symposium

10:10 - 11:00 Grand Opening Coffee Break with Exhibit & Poster Viewing

Session 2: Energy-Storage System Electrical Design and Management

Considering the high-voltage, long-life, and high-reliability requirements of the automotive and industrial applications on the one hand, and the volatility of the Li-Ion chemistry on the other, current battery packs include multiple electrical and mechanical components to ensure system reliability. In this session, pack designers and electrical and mechanical component suppliers will discuss the new developments that aim to simplify system design and reduce cost while ensuring system reliability.

11:00 - 11:05 Chairperson's Opening Remarks
Masato Origuchi, EV Battery Development Group Leader, Renault

11:05 - 11:25 Is Small or Big Beautiful and Cost Efficient? - A Cost and Benchmark Study of ZOE vs. Tesla Battery
Dr. Uwe Wiedemann, Senior Product Manager, AVL List GmbH

Cost is one of the most prominent aspects in the media today when E-mobility is being discussed. In a technical engineering perspective, cost needs to be considered in relation to other targets such as safety, durability and lifetime, and – of course – performance. Doing so, it is possible to differentiate more or less efficient systems; or in other words better and worse system designs. AVL Powertrain Engineering is an expert partner to the global automotive and mobility industry for the development of innovative powertrain systems. The competencies in batteries for electrification comprise cell, module and pack testing and benchmarking, mechanical and electrical design engineering, mechanical and thermal simulation, prototype and A/B sample build, BMS development (HW and SW) for series production as well as battery system validation. Based on this expertise, AVL is able to determine the best trade-off between the conflicting targets such as performance and cost for its different customers: cell/module suppliers, pack developers or OEM. This presentation will:

- Present findings from two benchmark projects (Tesla Model S and Renault ZOE)
- Reflect on the distinctions between larger and smaller battery systems
- Provide insight into the two batteries' cost breakdowns
- Relate the cost structures to the technical contribution of each subsystem (mechanic, EE, thermal) to the overall targets of safety, durability etc.
- Showcase implications on target costs and how an optimized battery system design can be reached systematically.

11:25 - 11:45 Has Battery Management for Li-Ion Battery Packs already become a commodity?
Dr. Peter Pichler, Director, Product Management, Marketing & Product Management, SAMSUNG SDI Battery Systems GmbH

11:45 - 12:05 Reducing Battery Specific Costs using Advanced Battery Management Systems
Dr. Olivier Cois, General Manager, Research and Development, Robert Bosch GmbH

The reduction of battery costs is nowadays one of the most challenging tasks to enable a wide market deployment of electromobility. In addition to conventional cost-down measures (Optimization of battery designs, manufacturing processes, supplier chain, business models, etc.), managing batteries using advanced algorithms can lead to significant specific cost savings by tackling technological roadblocks. Advanced Battery Modelling and Control techniques enable wider (and non-conservative) usages of batteries at operating points corresponding to optimal trade-offs between Performance and Ageing. Specifically, in this presentation we will:

- Examine the trends of PHEV & EV Li-Ion Battery Systems for the next generation
- Review the structures and functions of Battery Management Systems
- Present strategies increasing usable energy and fast charging performances
- Illustrate the advantage of Advanced Modelling through concrete examples of BMS development

12:05 - 12:25 Requirements on Data Acquisition in Battery Management Systems
Dr. Kai Peter Birke, Professor, Electrical Energy Storage Systems, Institute of Photovoltaics, University of Stuttgart;
Jan Singer, Research Assistant, University of Stuttgart

Modern Battery Management Systems (BMS) have tremendous requirements of 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 both, high sampling rates and high accuracy, increase costs and complexity of BMS due to expensive and complex electronic components. In this paper:

- requirements regarding must have accuracy of different Li-Ion cell chemistries are determined,
- lowering of sample rating times as an essential optimization parameter is outlined,
- appropriate and flexible upper and lower voltage limits for Li-Ion chemistries regarding the best compromise between usable energy content, safety and costs are presented,
- special requirements on measurement accuracy and speed for temperatures lower than 0° C are discussed,
- approaches for best cost BMS with sufficient low temperature reliability will be shown.

12:25 - 12:40 Q&A

12:40 - 13:55 Networking LUNCH

13:55 - 14:40 Dessert Break with Exhibit & Poster Viewing

Battery Engineering Symposium

Session 3: Lithium-Ion Battery Safety and Abuse Tolerance

Safety of the early large Li-Ion battery installations will have the greatest impact on market acceptance for the technology in automotive and industrial/stationary applications. In this session we will discuss safety enhancement technology and abuse tolerance validation in automotive and stationary/industrial usage.

14:40 - 14:45 Chairperson's Opening Remarks

Heinz-Willi Vassen, Manager Energy and Storage Systems, Audi AG

14:45 - 15:05 Safety Testing for xEV Batteries – Comparison of Test Standards and Validation Procedures

Michael Geppert, Chief Engineer, TÜV SÜD Battery Testing GmbH

Today a large variety of test standards and specifications are available in the field of safety validation of xEV batteries. Additionally, new methods and tests develop from growing experience with this technology. This presentation will compare various test standards and validation processes, focusing on:

- Comparison of test standards and homologation processes in Europe, North America and China
- Lessons learned and future developments
- Current examples of safety validation tests

15:05 - 15:25 Flammability of Li-Ion Battery Electrolytes

Dr. Mario Wachtler, Team Leader, ZSW – Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg

The inherent (thermal) safety of Li-ion batteries (LIBs) is determined by the safety of each cell component as well as by the interactions between the single components. One of the most critical constituents is the electrolyte. The state-of-the-art electrolytes are based on LiPF6 as electrolyte salt and mixtures of cyclic and linear organic carbonates as solvents. Especially the linear carbonates are highly volatile and flammable, and show flash points around room temperature. Due to their high volatility they dominate the behaviour of the whole electrolyte solution. In combination with an oxidant and an ignition source they can cause fires (and explosions). The availability of reliable descriptors of flammability is essential for the investigation of the flammability behaviour. Flash point and self-extinguishing time (SET) are the most common measures of flammability used by the battery community. Strategies to mitigate the fire hazard associated with the electrolyte include, for instance, the use of non-flammable electrolyte solvents and of flame-retardant electrolyte additives. Only with safe electrolytes will it be possible to build safer LIBs and batteries beyond LIBs.

This presentation will address:

- Procedures for flash point and self-extinguishing time (SET) measurements
- The comparison of flash points and SETs for a large number of solvents and electrolyte formulations
- The effect of the addition of flame retardants and ionic liquids to the electrolyte on the flammability
- Results from standardised safety tests of Li4Ti5O12 / LiFePO4 pouch cells with conventional electrolytes and electrolytes with low flammability.

15:25 - 15:45 Detection and Characterization of Lithium Plating in Commercial Cells

Dr. Michael Danzer, Head of Department (Deputy), Electrochemical Accumulators (ECA), ZSW – Zentrum für Sonnenenergie- und Wasserstoff-Forschung Baden-Württemberg

The deposition of metallic lithium on the negative electrode, also referred to as lithium plating, is one of the severest aging processes in lithium-ion batteries. Triggered by cell operation at high charging currents and low temperatures, lithium plating impairs the cell performance due to capacity loss and impedance rise. Furthermore, the deposited lithium may grow as dendrites that pose a serious safety hazard to the cell and its environment. In the laboratory the conditions for lithium plating, where the potential of the negative electrode falls below 0 V against the Li/Li+ potential, are measured by introducing reference electrodes close to the cell's anode. The verification that lithium plating occurred is done by cell opening and postmortem analysis. This presentation introduces different approaches for a non-destructive detection of lithium plating on the full cell level and focuses on:

- The polarization behavior of cells before and after plating
- The detection of reversible plating processes through differential voltage analysis
- The direct detection of lithium plating in pre-aged cells at room temperature
- Degradation processes leading to a higher susceptibility to plating and
- The ageing behavior of cells under plating conditions

15:45 - 16:05 Safety Enhancement Technology for Hard Shorts in Contrast to Soft Shorts

Dr. Brian Barnett, Vice President, TIAX LLC

Under suitable triggers/abuses, Li-ion cells can experience thermal runaway, i.e., a rapid increase in cell temperature accompanied by venting, vent-with-flame, ejection of cell parts, fire and explosion. Internal short circuits are the most commonly identified mechanism by which most safety failures occur in the field. In pursuit of a better understanding of these types of failures, we employed a variety of experimental methods to investigate the mechanism by which internal shorts develop and progress when originating from manufacturing defects, in contrast to "hard" shorts that result from crash/crush/penetration events. Our experiments clearly reinforce the significance that underlying physics for these different failure mechanisms can be quite different, with different reaction kinetics and timing to failure post trigger. This presentation will discuss the key issues associated with characterizing each of the classes of internal short, providing data from a variety of tests we have carried out, and then suggesting specific approaches by which each type of short can be managed effectively in Li-ion battery packs. Key topics discussed will include:

- Data illustrating the differences in mechanism and time-based progression between grown-in internal shorts and hard shorts that result from crash/crush/penetration.
- Approaches that can be employed in battery packs to provide suitable protections.
- Effectiveness and applicability of standardized safety tests for each class of short.

Battery Engineering Symposium

- Availability of technical solutions that address each failure mode.
- Short detection technology and hardware that can provide reliable early detection and opportunities for productive intervention (with demonstration).
- Summary: how each type of internal short can be managed.

16:05 - 16:25 Fault-Tolerant BMS Design Concept
Minkyu Lee, CTO, Navitas Solutions, Inc.

16:25 - 16:45 Q&A

16:45 - 17:45 Networking Reception with Exhibit & Poster Viewing

Sponsored by Johnson Controls

Advanced Automotive Battery Technology, Application & Market Conference

Track 1: High-Volume Automotive

WEDNESDAY 27 JANUARY 2016

8:00 - 18:00 Registration

Session 1: xEV and Industrial Battery Market

(Joint session with Track 2: Industrial and Specialty Automotive)

The automotive and industrial markets present great opportunities for developers of advanced high-energy batteries. Battery requirements vary with the applications, offering openings for multiple technologies. In this session we will discuss the development of the hybrid and electric vehicle and battery markets and the prospects of advanced batteries in the traditional industrial battery market, while assessing market drivers, competing technologies, and technological and commercial challenges.

9:00 - 9:05 Chairperson's Opening Remarks

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

9:05 - 9:25 Development of the New Prius

Michael Lord, Executive Engineer, Toyota Motor Engineering & Manufacturing, NA

9:25 - 9:50 Current Situation Regarding xEV-Batteries in the Chinese Market and Future Outlook

Dr. Mark Lu, Certified Senior Industrial Analyst, Industrial Economics & Knowledge Center (IEK), Industrial Technology Research Institute (ITRI)

In 2013, Chinese xEV sales were 17,642 units. This figure grew by well over 300% in 2014, making total sales of 74,763. In the first half of 2015, total sales were 78,500, and it is predicted total sales will top 210,000 by the year end. This growth in demand continues to constitute an equivalent growth in the demand for batteries, which has attracted overseas battery manufacturers, such as Samsung SDI, LGC and Boston Power. As the result of this increase, the Chinese government introduced some guidelines regarding eligibility for subsidies. These guidelines have changed the dynamics of the companies in the market. Therefore the purpose of this presentation is to allow the audience to see the scope of the market, recognize the leading companies, understand the changes in dynamics and receive suggestions on entering the market. This presentation will focus on the following areas:

- The current Chinese xEV sales, leading OEMs and models in 2015
- The market scope of Chinese xEV batteries by different segmentations (passenger car/E-Buses, PHEV/BEV)
- An overview of the leading companies in the market
- An introduction of the new guidelines issued by the Chinese government
- Changes in the dynamics of the companies in the market
- Suggestions for overseas companies wishing to enter the Chinese market

9:50 - 10:10 Present Status and Future Outlook of LiB Materials Market

Sachiya Inagaki, Industrial Technology Unit, Yano Research Institute, Ltd.

In this seminar, I am intending to mainly talk about the market overview, manufactures and technical trends of the four major LIB materials, namely, cathode, anode, electrolyte solutions and separators which largely determine the specifications of LIBs, and about how they are related to the overall LIB market trends. I will also make some recommendations about how LIB material manufacturers should cope with the ever-changing and diversifying market needs.

10:10 - 11:00 Coffee Break with Exhibit & Poster Viewing

Sponsored by Maxwell Technologies Enabling Energy's Future™

11:00 - 11:40 xEV Industry Advances: Technology and Market

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

No longer able to meet the tightening government emission regulations with conventional diesel and gasoline engines, automakers will commence rapid expansion of their xEV offerings starting in 2018. Without clarity regarding the customers' appetite for these vehicles, developers are spreading their bets on multiple architectures—mild and strong hybrids, plug-in hybrids, battery and fuel-cell electric vehicles—striving to meet the regulations at a cost they can pass to their customers. The technical success of the first generation of Li-Ion-powered xEVs, which have now been up to 6 years in the market, forms a good basis for the development of 2nd-generation technology. As xEV volume expands, the batteries' energy density must increase to ease battery packaging in the car, and their cost must drastically come down to make the xEVs affordable to customers. The technical challenge for battery developers then is to enhance performance and reduce cost while maintaining or improving durability, reliability, and safety. In this presentation, electrified-vehicle market and battery technology and market development from micro-hybrids to full EVs will be discussed, including:

"The networking at AABC Europe is excellent. One week of AABC equals a one-month tour around the world to all major car OEMs."

- Tom Van Bellinghen, Umicore

Advanced Automotive Battery Technology, Application & Market Conference

Track 1: High-Volume Automotive

- xEV Market drivers
- Battery-technology progress as enabler
- xEV market
- xEV-battery market

11:40 - 12:05 xEV Market Trend and its Impact on Battery Business
Sakuto Goda, Group Manager, Nomura Research Institute
The xEV and battery markets have experienced healthy growth during these 5 years. Now the markets are facing the new market phases and uncertainty. The markets will be driven by regulations for xEVs, but they are still unclear due to unexpected issues; besides, there are a lot of potential new entrants in xEV markets: entrants from different industries, fuel cell electric vehicle, and new customers in emerging countries which will be "long tail" customers. Battery suppliers should be flexible, establish robust strategy or be specialized to penetrate these new customers or competitors. This presentation includes:

- What was the market development in 2014?
- What will be the drivers for xEVs and batteries?
- What should be the market development in the future?
- What are the key factors for success in the future?

12:05 - 12:30 Q&A

12:30 - 13:30 Networking LUNCH

Sponsored by A123 SYSTEMS

13:30 - 14:15 Dessert Break with Exhibit & Poster Viewing

Session 2: Energy Storage for Low-Voltage Hybrids

Multiple energy-storage requirements for the wide spectrum of hybrid-vehicle architectures create opportunities for multiple cell chemistries and system designs. In this session, automakers will present vehicle development and energy-storage requirements for micro- and mild-hybrid vehicles, and energy-storage developers will present the latest achievements in meeting the requirements of the various low-voltage architectures.

14:15 - 14:20 Chairperson's Opening Remarks
Dr. Eckhard Karden, Technical Expert, Ford Research Aachen

14:20 - 14:40 Energy-Storage Solutions for Advanced 14V Systems
Christian Mondoloni, Specialist, 12V Storage System Components, PSA Peugeot Citroen
Advanced storage system solutions are necessary to cover the increasing level demand of car micro-hybridization. CO2 reduction emission Corporate Average Fuel Economy targets expected beyond 2020 are not covered by basic "microhybrid" cars with internal combustion engine, simple energy recuperation and STOP/START functions and equipped with a single EFB or AGM lead acid starter battery. The presentation will remind the upper level car requirements for "microhybrid" and advanced "microhybrid" cars at the electrical power system and how they can be addressed through different electrical architectures and associated storage system solutions to cover SLI + microhybrid functions:

> "Many actors of the sector are present at AABC Europe. If I should choose only one conference per year, I might choose this one."
>
> ***Mathilde Ouattara-Brigaudet, Valeo***

- Advanced single lead acid
- Dual lead acid
- Lead acid / Li-ion
- Lead acid / Ultra-capacitors

Replacement opportunity (mass reduction) or necessity (lead banishment risk if lead exemption as part of End of Life Vehicle European directive is abandoned) of single lead acid by single Li-ion drop-in SLI functions will be also discussed.

14:40 - 15:00 Valeo Mild Hybrid Solution: Interactive Behavior and Benefits Analysis in a 12+12V Battery Architecture
Yejin Jin, System & Hybrid Integration Department Manager, Valeo
In order to reach Europe CAFE 95g/km target in 2021, Valeo leads the development of whole panel of e-machine solutions in Low Voltage as well as in High voltage. Among these solutions, 12+12V architectures attract strong attention from the market thanks to its significant CO2 reduction potential versus highly interesting cost. Still, the cost competitive solution is not free of technical challenges. This presentation will illustrate the challenges that we face in 12+12v system architectures and some key technical elements of Li ion / Pb battery that are judged to be necessary to succeed in mild hybridization in 12V.

- 12+12V benefits
- Challenges for the vehicle system
- Challenges for the battery
- Conclusions and key requirements for 12+12 battery

15:00 - 15:20 Potential of Low Voltage Power Supply Systems for Upcoming Vehicle Applications
Dr. Andre Körner, Leader, Advanced Development for Energy Management, Hella KGaA Hueck & Co.

15:20 - 15:40 Advanced Lead Acid for 14V Applications
Dr. Christian Rosenkranz, Vice President, Engineering EMEA, Johnson Controls, Inc.

15:40 - 16:30 Refreshment Break in the Exhibit Hall with Poster Viewing

Advanced Automotive Battery Technology, Application & Market Conference

Track 1: High-Volume Automotive

16:30 - 16:50 Performance Advances in Flooded Type ISS Battery with the New Separator Design (Gen.3)

Tetsuro Okoshi, Researcher, Hitachi Chem. Co., Ltd.

The idling stop system (ISS) vehicle is quickly expanded for the correspondence to increasing fuel consumption regulation. EFB which shows high charge acceptance compared with VRLA is expected to expand market share from perspective of fuel consumption improvement in the future. In order to meet the fuel consumption improvement demand of the ISS vehicle, Hitachi chemical has been continued technical improvement of EFB. New technology such as new separator design was adapted to Gen.3. Because the new separator design prevented acid stratification in charge-discharge cycles, Gen.3 was improved in durability greatly to Gen.2. As a result, Gen.3 showed equal durability to VRLA under general pattern in Europe where high durability is demanded. Furthermore, Gen.3 showed high charge acceptance compared with VRLA. From a result of simulation, it was showed that fuel consumption improved with improving charge acceptance. It is expected that Gen.3 will meet the demands of durability and charge acceptance in the Europe market. In order to meet the higher fuel consumption demand, the technical development of durability and charge acceptance will be continued. These issues include:

Background

- Background to expansion of ISS vehicle
- Demands of EFB

Development of Gen.3 (EFB)

- Purpose of new type separator design
- Principle of new type separator design
- Evaluation results against generally pattern in Europe

Specification and performance evaluation of Gen.3 (EN type)

Summary

16:50 - 17:10 Li-Ion Battery for 48V Applications

Matthias Schneider, Technical Project Manager, 48V Li-Ion Battery, Audi AG

Audi AG is developing a 48V power supply to cover the upcoming demand of more energy and power in the vehicle structure. There could be new functions integrated on a 48V power supply, that would help to reduce the emission of a vehicle and offer some new features to the costumer. A powerful and lightweight 48V battery is necessary to provide the relevant power and energy. Therefore AUDI AG is developing a 48V lithium-ion battery. This battery is developed under the aspect of the module strategy of the Volkswagen group and can be used in several different platforms of the MLBevo and MQB architecture. The battery is integrated into different 48V concepts such as electrical superchargers or mild hybrid electrical vehicles (mHEV). There will be a challenge to integrate the battery into more platforms and concepts with different requirements in power and energy demand in the near future. Therefore it's necessary to develop new strategies for 48V lithium-ion batteries such as increasing of the temperature performance, higher safety features or scalable module concepts. This presentation illustrates steps during development to cover different requirements within the Volkswagen group, examines some key figures of the development and give a forecast of near future strategies for 48V lithium-ion batteries.

48V System overview in aspect of power and energy demand

- Presentation of current development status of 48V power supply
- Energy and power requirements for 48V lithium-ion battery

Key figures of battery development

- Module strategy of Volkswagen group
- Melting pot of requirements

Near future strategies for 48V lithium-ion batteries

- Increase battery performance esp. for temperature and safety
- Identifying possible concepts for scalable modules

17:10 - 17:30 Supercap-Based Storage Systems for Transient High-Power Loads

Christian Brosig, Director, Sales & Key Account Management, Fahrzeugelektronik / Automotive Electronics, Eberspächer Controls Landau GmbH & Co. KG

The power supply for new electric function is playing a central role in the development of future vehicles. When designing customized power supply solutions for new electric functions and its related transient loads a compromise between energy and power density has to be made. Moreover technical challenges like functional safety of the system have to be considered to secure the stability of the electrical system and availability of safety relevant functions. System complexity is driven in addition to that by different voltage levels and board net topologies that are applied for new electric transient loads. Depending on the power demand EDLC storages (Electric Double Layer Capacitor) solutions at different voltage levels can offer several advantages. For the target applications power supply and recuperation there are different cell solutions available. Besides Li-Ion cells there are currently especially EDLCs that are applied for these kind of applications. EDLC describes electrochemical capacitors with carbonate electrodes whereas related Li-Caps have special electrodes that exhibit both significant double-layer capacitance and pseudo-capacitance. The advantages of this technology are the low ESR (Electrical Series Resistance) which is almost stable over the whole temperature range resulting into high power density, high availability and low losses. Further advantages are life endurance and capability for cyclization having a positive impact on the total cost of ownership. With further improvements in capacity and power density DLC or Li-Cap based storage systems will be part of the further electrification of functions whether it is for conventional vehicles with combustion engine, mild hybrids or even PHEVs.

17:30 - 18:00 Q&A

18:00 - 19:30 Networking Reception with Exhibit & Poster Viewing

Sponsored by TOYOTA

THURSDAY 28 JANUARY 2016

8:00 - 17:30 Registration

Advanced Automotive Battery Technology, Application & Market Conference

Track 1: High-Volume Automotive

Session 3: High-Voltage xEV Battery Technology

Lithium Ion is the predominant battery technology to power the expanding plug-in hybrids and all-electric vehicles. Cell chemistry and mechanical design vary among developers as they try to balance safety, durability, performance, and cost to improve the value proposition of the technology. In this session, EV/PHEV/HEV vehicle and battery developers will discuss the chosen battery designs and present performance data.

9:00 - 9:05 Chairperson's Opening Remarks
Dr. Arnold Lamm, Head, High Voltage Battery Systems, Daimler AG

9:05 - 9:25 Battery Systems for Volkswagen e-Golf EV and Golf GTE
Dr. Matthias Ullrich, Traction Battery Technology Development, Electric/Electronics, Vokswagen AG

Volkswagen has released two electrified versions of its popular compact vehicle, the Golf. The e-Golf is a pure electric vehicle (BEV) with a range of 190km (NEDC). It features a 85kW electrical engine and a 24 kWh battery pack. The Golf GTE is a gasoline plug-in hybrid vehicle (PHEV) with an pure electric range of 50km (NEDC). The 8.8 kWh battery pack powers the 75kW electrical machine. Long range mobility is provided by the 110kW gasoline TSI engine. Both vehicles share a conversion design of the original Golf platform. Moreover for both cars the same battery cells and similar cell modules have been used. The presentation introduces the battery systems of e-Golf and Golf GTE with respect to mechanical, electrical and thermal design. Key performance figures will be presented.

9:25 - 9:45 First Field Experiences of Mercedes-Benz Plug-in Hybrids
Dr. Tobias Handschuh, Team Leader, Hybrid Batteries, Daimler AG

9:45 - 10:05 Li-Ion Battery for Audi Q7 PHEV
Thomas Glass, Technical Project Manager PHEV Battery Q7, Audi AG

The Audi Q7 e-tron quattro is sporty, comfortable and at the same time highly efficient. The world's first TDI plug-in hybrid with quattro drive, it is also the first plug-in hybrid with a diesel engine from Audi. Like all Audi hybrid models, the Q7 e-tron quattro has also been designed as a parallel hybrid. The lithium-ion battery consists of 168 high-quality battery cells and is fluid-cooled. With a capacity of 17.3 kWh, it allows a 56 kilometer (34.8 mi) range in electric mode. In this presentation the battery system of the Q7 e-tron Quattro will be introduced, which has several features combined to an highly efficient, highly modular and very safe battery system.

1. Overview of the battery system
- Mechanical Overview
- Advantages/disadvantages of 1p and 2p systems

2. Architecture
- Modular set part concept
- SW Architecture
- Advantages of standard automotive communication

3. Safety features of the Q7 PHEV battery
- Structure
- Cooling

10:05 - 10:50 Coffee Break with Exhibit & Poster Viewing

Sponsored by AVL

10:50 - 11:10 The Future of EVs and Fast Charging at 800V
Dr. Christian Jung, Development Engineer, Porsche AG

Most of today's electric vehicles show a realistic electric range of less than 200 km - enough for most of the daily drives. Nevertheless experience shows that this approach doesn't satisfy all customer expectations. The success factor for e-mobility is an electric range comparable to ICE vehicles in combination with comfortable and fast charging. These demands can be met by implementation of the 800 Volt technology. Based on motor sport experience, Porsche started to transfer this technology into series development. Thereto some components have to be adjusted, 800 V infrastructure must be rolled out and standards have to be expanded. This presentation discusses advantages and the strategic importance of this innovation.

11:10 - 11:30 Advances in High-Energy Density Lithium-ion Polymer Battery for PHEV & EV
Dr. Seungdon Choi, Research Fellow, LG Chem, Ltd.

Among xEV's (HEV, PHEV & EV), major portion of demand has been on HEV so far, even with many efforts by battery & car industries. However, it is predicted that future xEV market growth will be led by PHEV and EV demand. This growth will be realized by several factors like improved battery technology, stronger vehicle performance, better infrastructure and so on. This presentation will cover especially on the recent improvement of high energy battery technology which is one of major enabling technologies for future PHEV & EV market.

There are two directions for PHEV cell development. One is higher energy density to increase EV driving range & the other is higher power density to increase performance.

In case of EV, there is clear demand to achieve quick charging capability while maintaining high energy density (equivalent to > 300miles, Long range EV)

- Introduction of LG Chem's Automotive Battery Business

Product line-up for xEV under mass production

Mass production history

- High energy battery development for PHEV

Higher energy density PHEV cell development

Higher power density PHEV cell development

Development roadmap

- High energy battery development for LREV

Long range (>300miles) EV cell development

Quick charging EV cell development

- Conclusion

11:30 - 11:50 Li-Ion Batteries for Electrified Mobility - Quo vadis?

Mario Rustosch, Robert Bosch Battery Systems GmbH

The market success of electrified mobility (eMobility) is driven by megatrends such as energy efficiency as well as the availability of infrastructure, user experience, business models and the performance of technology. The battery will make up more than 70% of the battery electrical vehicle`s powertrain weight, volume and cost. This is why Bosch considers the battery as core element for the success of eMobility. This presentation gives a detailed analysis of available cell technologies with respect to the key performance indicators, such as driving range, energy density and costs. The future battery requirements can only be achieved by optimizing the battery as a system. This optimization starts from the cell and continues with mechanical integration, battery control, standardization, etc. The lithium ion technology cells (LIT) still have a significant room for improvement. Nevertheless the next generation of automotive cells, so called post lithium ion technology cells (PLIT), will contribute with a further increase in energy density and decrease in production costs. The presentation concludes with an outlook if and how the change from LIT to PLIT will happen.

11:50 - 12:15 Q&A

12:15 - 13:00 Networking LUNCH

Sponsored by Hitachi Chemical

13:00 - 14:00 Dessert Break with Exhibit & Poster Viewing

Session 4: Battery-Charging, Transportation, and Recycling/Reuse

(Joint session with Track 4: Industrial and Specialty Automotive)

In this session, EV and infrastructure developers and related stakeholders will discuss plans to address the technological and commercial challenges associated with vehicle electrification, including: charging technology, grid integration, transportation, maintenance, secondary use, and recycling.

14:00 - 14:05 Chairperson's Opening Remarks

Dr. Juergen Hildinger, Team Leader, Advanced Development, Cell Technology, BMW

14:05 - 14:25 AC or DC? Fast or Slow? Charging EVs in Germany

Dr. Fritz Rettberg, Head of E-Mobility, ie³ Institute of Energy Systems, Energy Efficiency and Energy Economics, Technical University of Dortmund

In order to reach the goal of national governments to reduce the CO2 emission, the change from fossil mobility to electric mobility can be a mighty measure if Renewable Energy Sources (RES) are used for charging the electric vehicles (EV). A successful change needs charging infrastructure with special requirements. On the one hand the needed energy has to be generated by RES on acceptable costs and on the other hand charging infrastructure that connects the EV's batteries in a secure and sufficient way with the power grid has to be available comprehensively. Therefore, it is necessary to make a distinction between technologies and standards for public, semi-public and private charging spots. In addition, a regulatory framework is needed that allows business models with respect to the flexible use of the EV's batteries by intelligent charging processes. The presentation will discuss current approaches of charging infrastructure and business models in Germany and will shed some light on the recommendations of the German National Platform for E-Mobility (NPE).

14:25 - 14:45 Current Status and Outlook of Standardization for Wireless Electric Vehicle Charging Systems

Dr. Sebastian Mathar, Senior Engineer, Qualcomm

Currently, several national and international standardization bodies are dealing with Wireless Electric Vehicle Charging (WEVC) systems. On international level, IEC (International Electrotechnical Commission) has established a project team to develop an International Standard (IEC 61980) for WEVC. Due to the nature of all IEC work, this standard focuses on the specification of the infrastructure-side components. As a counterpart, ISO (International Standardization Organization) is currently developing a Public Available Specification (PAS 19363) for all WEVC vehicle-side components. SAE (Society of Automotive Engineers) is developing a WEVC Technical Information Report (TIR J2954), which will cover both the infrastructure and the vehicle side. In this paper, the current situation in the above-mentioned standardization committees is discussed with regard to several key parameters that are vital for ensuring interoperability. Examples for such parameters include the reference coil types, the system operation frequency and technologies used for detecting foreign objects which might heat up when placed on the base pad. Furthermore, the current status of standardization with regards to EMC is summarized. Finally, an outlook for the future work of IEC, ISO and SAE is provided.

14:45 - 15:05 Air Transport Regulations for Lithium-Ion Batteries and the Impact on the Automotive Market

David Brennan, Air Transport of Automotive Batteries, Cargo Safety and Standards, IATA

As the automotive industry expands the production of hybrid and all-electric vehicles powered by lithium-ion batteries the demand for the industry to be able to move these lithium-ion batteries by air will increase. Currently though any air transport of a lithium-ion battery with a mass in excess requires an approval from the civil aviation authority of the State (country) in which the battery will be loaded onto an aircraft, and the carriage of these batteries is restricted to all-cargo aircraft. These conditions limit the movement of large-format automotive lithium-ion batteries and place potentially significant delays and obstructions to the timely movement of these batteries. This session will look at the current air transport regulations; the safety considerations and concerns around the air transport of lithium-ion batteries, and what opportunities exist to make the transport of large automotive lithium-ion batteries more routine.

15:05 - 15:20 Coffee BREAK

15:20 - 15:40 Battery Safety Considerations During Storage, Transportation and Disposal

Jüergen Garche, General Manager, FCBAT Germany

The energy of a Li-ion cell is in average about 3,250 kJ/kg. About ¼ of this energy is related to electrochemical energy (chemical energy convertible into electrical energy via normal use or short circuit) and ¾ to thermal energy (chemical energy convertible only in thermal energy released at suitable stimulation; e.g. short

circuit). The main safety related events are overcharge, external heating, external and internal short circuits, and mechanical deformations of the cell/battery case. The lecture will give an overview about

- How would be triggered this thermodynamically risk in the field
- How to manage this thermodynamically given risk by proper design of cells, batteries and battery applications
- Safety relevant triggers which occur during transportation and storage, as external heating, external and internal short circuits, and mechanical deformations. Measures which can prevent them (e.g. reliable and low flammable packaging, thermal barriers) and transport related standards (e.g. UN 38.3) are described.
- Safety relevant triggers which occur in the disposal phase of the cell/battery, as external heating, external and internal short circuits, and mechanical deformations as well.
- Proof whether the cell/battery is defective (not all functions properly) or damaged (loss of physical integrity). Defective batteries with capacity ≤ 80 % of the nominal value (end-of-life by definition) could be still used in lower demanding applications, e.g. stationary storage in PV houses. Damaged batteries and defective batteries with << 80 % capacity and other malfunctions have to be recycled.
- Reduction of safety risks before the recycling process (including transport) by de-energizing the battery.

15:40 - 16:00 Battery Recycling and the Corresponding Potential Environmental Impacts

Willy Tomboy, Director, Recharge Batteries

Batteries in the EU are regulated by the Batteries Directive 2006/66/EC. The main objectives of this Directive is environmental protection, respecting the waste hierarchy, and ensure the single European market functions properly by harmonized measures. Since the time of the preparation of the Directive in 2005, the implementation in 2008, and today's situation, the market for batteries has drastically changed by a fast growing market of rechargeable lithium-ion battery technologies, by a diversification of chemistries, by a multiplication of applications, and by an increased energy content of these batteries. In the EU Commission Circular Economy Package, batteries and recycling and environment play a significant role. Issues such as extended producer responsibility, extending the product life (re-use and second use), quality of the recycling processes, safety and health and protection of stakeholders handling batteries in production, transport, storage, use, end-of life are being addressed, also in the product environmental footprint, where the reduction of environmental impacts thanks to recycling has been calculated. The real environmental impact, however, may arise from the fraction of batteries that is not taken-back or collected for recycling or being re-used, that is (il)legally exported and processed without the use of adequate technologies...

16:00 - 16:20 Battery Second Life: Redefining the Value Proposition for Stationary Battery Energy Storage Systems

Melissa Bowler, Technical Project Manager Stationary Battery Storage Systems and B2L, BMW

Innovation is the development or redefinition of value in a new or changing environment. BMW i is an innovative new approach to mobility that is necessary due to the developing context of the world around us. Through the use of integrated services to complement purpose built electric vehicles, the BMW Group has worked to redefine the value proposition of a vehicle to enable a more sustainable form of individual mobility. Through the development of the revolutionary i3 and i8 electric vehicles, it was determined that a conversion was an inefficient partial solution to the challenges of vehicle electrification. To date our experience with Battery Second Use and the use of EV batteries in a stationary application has proven to be no different. Simply using EV batteries in a stationary battery system is novel. Leveraging the USPs of an EV Battery System to realize a higher level of value over the lifecycle of both stationary and mobile applications is revolutionary. This talk will discuss the optimizations and potentials EV Batteries can offer to the stationary storage market.

16:20 - 16:40 Q&A

16:40 - 16:50 Closing Remarks

Advanced Automotive Battery Technology, Application & Market Conference

Track 2: Industrial and Specialty Automotive

WEDNESDAY 27 JANUARY 2016

8:00 - 18:00 Registration

Session 1: xEV and Industrial Battery Market

(Joint session with Track 1: High-Volume Automotive)

The automotive and industrial markets present great opportunities for developers of advanced high-energy batteries. Battery requirements vary with the applications, offering openings for multiple technologies. In this session we will discuss the development of the hybrid and electric vehicle and battery markets and the prospects of advanced batteries in the traditional industrial battery market, while assessing market drivers, competing technologies, and technological and commercial challenges.

9:00 - 9:05 Chairperson's Opening Remarks

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

9:05 - 9:25 Development of the New Prius

Michael Lord, Executive Engineer, Toyota Motor Engineering & Manufacturing, NA

9:25 - 9:50 Current Situation Regarding xEV-Batteries in the Chinese Market and Future Outlook

Dr. Mark Lu, Certified Senior Industrial Analyst, Industrial Economics & Knowledge Center (IEK), Industrial Technology Research Institute (ITRI)

In 2013, Chinese xEV sales were 17,642 units. This figure grew by well over 300% in 2014, making total sales of 74,763. In the first half of 2015, total sales were 78,500, and it is predicted total sales will top 210,000 by the year end. This growth in demand continues to constitute an equivalent growth in the demand for batteries, which has attracted overseas battery manufacturers, such as Samsung SDI, LGC and Boston Power. As a result of this increase, the Chinese government introduced some guidelines regarding eligibility for subsidies. These guidelines have changed the dynamics of the companies in the market. Therefore the purpose of this presentation is to allow the audience to see the scope of the market, recognize the leading companies, understand the changes in dynamics and receive suggestions on entering the market. This presentation will focus on the following areas:

- The current Chinese xEV sales, leading OEMs and models in 2015
- The market scope of Chinese xEV batteries by different segmentations (passenger car/E-Buses, PHEV/BEV)
- An overview of the leading companies in the market
- An introduction of the new guidelines issued by the Chinese government
- Changes in the dynamics of the companies in the market
- Suggestions for overseas companies wishing to enter the Chinese market

9:50 - 10:10 Present Status and Future Outlook of LiB Materials Market

Sachiya Inagaki, Industrial Technology Unit, Yano Research Institute, Ltd.

> "AABC is by far the best run conference I attend in any industry."
> ***Robert Craig, Corning, Inc.***

In this seminar, I am intending to mainly talk about the market overview, manufactures and technical trends of the four major LIB materials, namely, cathode, anode, electrolyte solutions and separators which largely determine the specifications of LIBs, and about how they are related to the overall LIB market trends. I will also make some recommendations about how LIB material manufacturers should cope with the ever-changing and diversifying market needs.

10:10 - 11:00 Coffee Break with Exhibit & Poster Viewing

Sponsored by Maxwell Technologies Enabling Energy's Future

11:00 - 11:40 xEV Industry Advances: Technology and Market

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

No longer able to meet the tightening government emission regulations with conventional diesel and gasoline engines, automakers will commence rapid expansion of their xEV offerings starting in 2018. Without clarity regarding the customers' appetite for these vehicles, developers are spreading their bets on multiple architectures—mild and strong hybrids, plug-in hybrids, battery and fuel-cell electric vehicles—striving to meet the regulations at a cost they can pass to their customers. The technical success of the first generation of Li-Ion-powered xEVs, which have now been up to 6 years in the market, forms a good basis for the development of 2nd-generation technology. As xEV volume expands, the batteries' energy density must increase to ease battery packaging in the car, and their cost must drastically come down to make the xEVs affordable to customers. The technical challenge for battery developers then is to enhance performance and reduce cost while maintaining or improving durability, reliability, and safety. In this presentation, electrified-vehicle market and battery technology and market development from micro-hybrids to full EVs will be discussed, including:

- xEV Market drivers
- Battery-technology progress as enabler
- xEV market
- xEV-battery market

11:40 - 12:05 xEV Market Trend and Its Impact on Battery Business

Sakuto Goda, Group Manager, Nomura Research Institute

The xEV and battery markets have experienced healthy growth during these 5 years. Now the markets are facing the new market phases and uncertainty. The markets will be driven by regulations for xEVs, but they are still unclear due to

Advanced Automotive Battery Technology, Application & Market Conference

Track 2: Industrial and Specialty Automotive

unexpected issues; besides, there are a lot of potential new entrants in xEV markets: entrants from different industries, fuel cell electric vehicle, and new customers in emerging countries which will be "long tail" customers. Battery suppliers should be flexible, establish robust strategy or be specialized to penetrate these new customers or competitors. This presentation includes:

- What was the market development in 2014?
- What will be the drivers for xEVs and batteries?
- What should be the market development in the future?
- What are the key factors for success in the future?

12:05 - 12:30 Q&A

Sponsored by A123 SYSTEMS

12:30 - 13:30 Networking LUNCH

13:30 - 14:15 Dessert Break with Exhibit & Poster Viewing

Session 2A: Light Electric Vehicles (LEVs) and their Battery Systems

Electrification of light vehicles, including bikes, scooters, and off-highway neighborhood vehicles is advancing at a steady pace. In this session, we will discuss the development of the light electric vehicle market and the recent advances in the batteries that power these vehicles.

14:15 - 14:20 Chairperson's Opening Remarks

Dr. Mo-Hua Yang, General Manager, TD HiTech Energy, Inc.; President, EnergyBus e.V.

14:20 - 14:40 What's the Next Standard LIB cell for LEVs and EVs Applications? The Trend of 18650 Standard Li-Ion Cell Developments

Dr. Mo-Hua Yang, General Manager, TD HiTech Energy, Inc.; President, EnergyBus e.V.

Thanks to the success story of Tesla EV marketing, the small standard 18650 LIB cell becomes possible for mass quantity battery system application in E-nobilities. The drastically increase of capacity of 18650 cell to 3.5Ah in the last years is almost reach to the material limitation. Cell manufacture companies start to propose the dimension change of 18650 cell for continued capacity increase but keeping the advantage of high quality, high reliability and cost effectiveness of standardization is challenging.

14:40 - 15:00 How IEC/ISO Standards for Light EV Battery Safety, Interoperability and Public Charging Interface will Influence Battery Demand and Design for Light EV Applications

Hannes Neupert, CEO, ExtraEnergy Services GmbH & Co. KG

Since 2010 the EU mandated harmonization of public charging interfaces for all EVs including the Light EV section representing the successful Pedeles as well as electric two wheelers and other vehicles below the car category. As a result the IEC started a standardization activity the IEA Hybrid and Electric Vehicle Implementing agreement has started in 2013 the Task 23 which is coordinating the

> "I will be back!"
> ***Chris Fehrenbacher, A123 Systems***

recommendations for local governments and cities on the requirements for public tenders acquiring public parking and charging infrastructure as well as shared Light EV solutions and battery swapping for Light EVs.

15:00 - 15:20 Lithium Batteries for Long Distance Electric Bike Applications

Susanne Bruesch, Founder and CEO, Pedelec Adventures

From a technical user perspective this presentation will provide a very practical insight on where the e-bike battery technology and mobile solar charging solutions currently are and where they need to go to meet market demand.

15:20 - 15:40 Q&A

15:40 - 16:25 Refreshment Break with Exhibit & Poster Viewing

Session 2B: Commercial xEVs and their Battery Systems

Commercial transportation, including buses, transit vans, delivery vehicles, hybrid trains, and electric boats typically have predictable duty cycles with significant stop-and-go operation, and thus present a unique opportunity for hybridization and electrification. In this session, vehicle and battery system developers will describe battery requirements and solutions for both hybridization and full electrification of these vehicles.

16:25 - 16:30 Chairperson's Opening Remarks

Dr. Jens Groot, Energy Storage Systems Specialist, Volvo

16:30 - 16:50 Commercial xEV Battery Systems: Cycle Life Testing and Cell Modelling at AB Volvo

Dr. Jens Groot, Energy Storage Systems Specialist, Volvo Group Trucks Technology

Although many heavy-duty vehicles are suitable for hybridization due to predictable duty cycles and high utilisation rates, they may also have very tough battery requirements; wide temperature range, frequent fast-charging and a no acceptance for unscheduled service or degradation of vehicle performance over life. In addition, heavy-duyty xEVs may be used differently based on the current market, season or time of the day, thus making optimisation of battery usage and sizing difficult. This presentation includes an overview of battery R&D within AB Volvo focusing on cycle life testing, cell modelling and state-of-health estimation.

Advanced Automotive Battery Technology, Application & Market Conference

Track 2: Industrial and Specialty Automotive

16:50 - 17:10 Full Electric Long Haul Transport - eHighway Combinations with On-Board Energy Storage

Henrik Engdahl, Product Manager, eHighway, Siemens AG

The eHighway system aims to enable cost efficient electrification of heavy duty vehicles, especially targeting applications with high energy demand. An on-board electrical energy storage is an important component in such a system, especially on road sections where erection of infrastructure is cost inefficient or technically challenging. This presentation gives a short overview of the eHighway concept and discusses the technical and operational characteristics of on-board energy storages necessary for a full-electric transport chain.

17:10 - 17:30 Energy Storage Solutions for Hybrid Trucks and City Buses

Christoph Fehrenbacher, Managing Director, Europe, A123 Systems

Buses and trucks are a source of air pollution in major cities and make a contribution to greenhouse gas emissions. In city duty cycles with low average speed and frequent stops, hybridization can have a significant effect on fuel economy also reflected in lower exhaust emissions. Over 30% less fuel consumption is achievable according to publications of bus manufacturers. The presentation will give examples and cover system requirements for typical heavy-duty hybrid applications. Cell and system design as well as life projections will be discussed on the basis of a case study.

17:30 - 18:00 Q&A

18:00 - 19:30 Networking Reception with Exhibit & Poster Viewing

Sponsored by TOYOTA

THURSDAY 28 JANUARY 2016

8:00 - 17:30 Registration

Session 3: Automotive Battery Technology for Industrial Energy Storage Applications

Advanced automotive battery technology is creating significant new opportunities for varied high-energy applications within the industrial energy storage market. This session will examine these applications and their viability to achieve significant market share while overcoming technological and safety challenges.

9:00 - 9:05 Chairperson's Opening Remarks

Dr. Axel Thielmann, Deputy Head of Competence Center Emerging Technologies, Fraunhofer ISI, Germany

9:05 - 9:25 Trends, Markets and Business Scenarios of Battery Based Energy Storage for Electric Vehicles and Stationary Applications

Dr. Axel Thielmann, Deputy Head of Competence Center Emerging Technologies, Fraunhofer ISI

The talk will provide roadmaps on Lithium-Ion battery (LIB) developments in the fields of electric mobility (xEV and beyond), stationary energy storage (ESS) applications and will highlight potential interdependencies of market opportunities linked to the technological and cost development of LIB and alternative technologies. Market and business scenarios are drawn for the next decade and the long term on a global and partly regional/country level. The LIB developments will be assessed against the broader technology portfolio especially for ESS (e.g. redox flow batteries, lead acid batteries, hydrogen storage, thermal storage, and others).

9:25 - 9:45 Advanced Polypropylene Battery Separators - Applications and Markets

Dr. Franz Josef Kruger, Head of Business Unit, TreoPore, Treofan Germany GmbH

Under the brand name Treopore, Treofan has developed a dry process for manufacturing biaxially stretched polypropylene-based films combining high mechanical and temperature stability with a nano-porous structure that can even be customized. The company is a world leading manufacturer of bi-axially oriented polypropylene (BOPP) films for a broad area of applications, such as packaging films and labels for the food industry, the tobacco industry and separators for capacitors, li-ion batteries and other energy storage devices. The article describes the unique Treopore separator properties and performance in large format li-ion cells for xEV and ESS markets.

9:45 - 10:05 New Approach for Battery Storage Systems in Industrial Applications and Micro Grids

Dr. Stefan Meir, Senior Scientist, VARTA Storage

The analysis of the application of battery storage systems in industrial environment and in micro grid is revealing a wide spectrum of requirements with respect to power, capacity etc.. An advanced battery storage system must be able to fulfill most of the requirements by an acceptable market price. VARTA Storage present the latest results of its new approach for battery storage systems which manages the balancing act.

Sponsored by AVL

10:05 - 10:50 Coffee Break with Exhibit & Poster Viewing

10:50 - 11:10 Mercedes-Benz Energy Storage: Stationary Battery Storage based on Li-Ion Automotive Product Platform

Dr. Hartung Wilstermann, General Manager, Deutsche ACCUmotive GmbH & Co. KG

In 2009 Mercedes-Benz was the first OEM launching a Li-Ion battery in an automotive application. In the meanwhile the Li-Ion technology is the worldwide standard for automotive battery systems. The development of automotive batteries for e-mobility applications is very challenging, since many requirements have to be taken into consideration. In contrast are stationary energy storage requirements lower especially for vibrations, cycling and temperature profiles. This presentation will show that a takeover of automotive batteries for stationary application is the best and most consistent choice for both applications. This is especially true for product safety but also for robustness and economy of scales. Therefor the development of the Mercedes-Benz energy storage is the most consequent continuation and implementation of the pioneering feat in the field of automotive Li-Ion batteries.

Advanced Automotive Battery Technology, Application & Market Conference

Track 2: Industrial and Specialty Automotive

11:10 - 11:30 Design and Operation of Large Scale Battery Storage Systems

Michael Schreieder, Head, Battery Technology, Younicos AG

Large scale battery storage systems are becoming an fundamental component of the global energy system. This presentation will focus on mechanical and electrical design of Lithium-Ion battery storage systems, containing an overview of the system layout and different operational strategies

11:30 - 11:50 Challenges in Development of Low Cost Lithium-Ion Battery Materials for Grid Applications

Dr. Ke Zhang, Senior Research Scientist, Huntsman Performance Products

Dr. Dee Strand, Chief Scientific Officer, Wildcat Discovery Technologies

Grid storage applications present unique opportunities for lithium ion battery technologies with long life, high energy density, and high power capability. However, the lifetimes required for grid energy storage are beyond those for typical lithium ion applications such as consumer electronics and even automotive use. Therefore, novel materials and combinations of material components are required to meet performance of this new energy storage market. This presentation will focus on challenges of developing and demonstrating materials adequate for grid storage. For example, high energy density, long life lithium ion batteries require stringent purity requirements for all components within the cell. Most commercial cells today contain ethylene carbonate (EC) as a key solvent in the electrolyte formulation. The elimination or reduction of impurities such as water, residual glycol, and color bodies in the solvent can add significant cost. Therefore, it is critical to understand the effects of impurities on battery performance. The Performance Products division of Huntsman Corporation is a global manufacturer and marketer of more than 2,000 specialty chemicals and licenses 35 process technologies used in energy, agrochemicals, home and personal care, additives, and performance chemicals. Key product groups include amines, carbonates, ethylene oxide, glycols, maleic anhydride, and surfactants. Headquartered in The Woodlands, TX, USA, the company has 20 manufacturing locations, more than 2,000 employees, and more than 4,000 customers in 100 countries. Huntsman is a world leader and innovator in high purity cyclic carbonates, which it markets under its ULTRAPURE® carbonate brand. Wildcat Discovery Technologies is involved in the discovery and development of materials for lithium-ion batteries. Using proprietary high throughput tools, Wildcat can synthesize and over 1,500 new materials per week and then measure capacity, power, voltage, and cycle life for those materials in actual battery cells. Wildcat works with companies throughout the battery industry on all parts of the battery – cathodes, anodes, electrolytes and additives. As a result, Wildcat helps its customers accelerate battery performance improvements, significantly reduce R&D costs and speed the introduction of their products to market.

11:50 - 12:15 Q&A

12:15 - 13:00 Networking LUNCH

Sponsored by Hitachi Chemical

13:00 - 14:00 Dessert Break with Exhibit & Poster Viewing

Session 4: Battery-Charging, Transportation, and Recycling/Reuse

(Joint session with Track 4: High-Volume Automotive)

In this session, EV and infrastructure developers and related stakeholders will discuss plans to address the technological and commercial challenges associated with vehicle electrification, including: charging technology, grid integration, transportation, maintenance, secondary use, and recycling.

14:00 - 14:05 Chairperson's Opening Remarks

Dr. Juergen Hildinger, Team Leader Advanced Development, Cell Technology, BMW

14:05 - 14:25 AC or DC? Fast or Slow? Charging EVs in Germany

Dr. Fritz Rettberg, Head of E-Mobility, ie³ Institute of Energy Systems, Energy Efficiency and Energy Economics , Technical University of Dortmund

In order to reach the goal of national governments to reduce the CO2 emission, the change from fossil mobility to electric mobility can be a mighty measure if Renewable Energy Sources (RES) are used for charging the electric vehicles (EV). A successful change needs charging infrastructure with special requirements. On the one hand the needed energy has to be generated by RES on acceptable costs and on the other hand charging infrastructure that connects the EV's batteries in a secure and sufficient way with the power grid has to be available comprehensively. Therefore, it is necessary to make a distinction between technologies and standards for public, semi-public and private charging spots. In addition, a regulatory framework is needed that allows business models with respect to the flexible use of the EV's batteries by intelligent charging processes. The presentation will discuss current approaches of charging infrastructure and business models in Germany and will shed some light on the recommendations of the German National Platform for E-Mobility (NPE).

14:25 - 14:45 Current Status and Outlook of Standardization for Wireless Electric Vehicle Charging Systems

Dr. Sebastian Mathar, Senior Engineer, Qualcomm

Currently, several national and international standardization bodies are dealing with Wireless Electric Vehicle Charging (WEVC) systems. On an international level, IEC (International Electrotechnical Commission) has established a project team to develop an International Standard (IEC 61980) for WEVC. Due to the nature of all IEC work, this standard focuses on the specification of the infrastructure-side components. As a counterpart, ISO (International Standardization Organization) is currently developing a Public Available Specification (PAS 19363) for all WEVC vehicle-side components. SAE (Society of Automotive Engineers) is developing a WEVC Technical Information Report (TIR J2954), which will cover both the infrastructure and the vehicle side. In this paper, the current situation in the above-mentioned standardization committees is discussed with regard to several key parameters that are vital for ensuring interoperability. Examples for such parameters include the reference coil types, the system operation frequency and technologies used for detecting foreign objects which might heat up when placed on the base pad. Furthermore, the current status of standardization with regards to EMC is summarized. Finally, an outlook for the future work of IEC, ISO and SAE is provided.

Advanced Automotive Battery Technology, Application & Market Conference

Track 2: Industrial and Specialty Automotive

14:45 - 15:05 Air Transport Regulations for Lithium-Ion Batteries and the Impact on the Automotive Market

David Brennan, Air Transport of Automotive Batteries, Cargo Safety and Standards, IATA

As the automotive industry expands the production of hybrid and all-electric vehicles powered by lithium ion batteries the demand for the industry to be able to move these lithium ion batteries by air will increase. Currently though any air transport of a lithium ion battery with a mass in excess requires an approval from the civil aviation authority of the State (country) in which the battery will be loaded onto an aircraft, and the carriage of these batteries is restricted to all-cargo aircraft. These conditions limit the movement of large-format automotive lithium ion batteries and place potentially significant delays and obstructions to the timely movement of these batteries. This session will look at the current air transport regulations; the safety considerations and concerns around the air transport of lithium ion batteries, and what opportunities exist to make the transport of large automotive lithium ion batteries more routine.

15:05 - 15:20 Coffee BREAK

15:20 - 15:40 Battery Safety Considerations During Storage, Transportation and Disposal

Jüergen Garche, General Manager, FCBAT Germany

The energy of a Li-ion cell is in average about 3,250 kJ/kg. About ¼ of this energy is related to electrochemical energy (chemical energy convertible into electrical energy via normal use or short circuit) and ¾ to thermal energy (chemical energy convertible only in thermal energy released at suitable stimulation; e.g. short circuit). The main safety related events are overcharge, external heating, external and internal short circuits, and mechanical deformations of the cell/battery case. The lecture will give an overview about

- How would be triggered this thermodynamically risk in the field
- How to manage this thermodynamically given risk by proper design of cells, batteries and battery applications
- Safety relevant triggers which occur during transportation and storage, as external heating, external and internal short circuits, and mechanical deformations. Measures which can prevent them (e.g. reliable and low flammable packaging, thermal barriers) and transport related standards (e.g. UN 38.3) are described.
- Safety relevant triggers which occur in the disposal phase of the cell/battery, as external heating, external and internal short circuits, and mechanical deformations as well.
- Proof whether the cell/battery is defective (not all functions properly) or damaged (loss of physical integrity). Defective batteries with capacity ≤ 80 % of the nominal value (end-of-life by definition) could be still used in lower demanding applications, e.g. stationary storage in PV houses. Damaged batteries and defective batteries with << 80 % capacity and other malfunctions have to be recycled.
- Reduction of safety risks before the recycling process (including transport) by de-energizing the battery.

15:40 - 16:00 Battery Recycling and the Corresponding Potential Environmental Impacts

Willy Tomboy, Director, Recharge Batteries

Batteries in the EU are regulated by the Batteries Directive 2006/66/EC. The main objectives of this Directive is environmental protection, respecting the waste hierarchy, and ensure the single European market functions properly by harmonized measures. Since the time of the preparation of the Directive in 2005, the implementation in 2008, and today's situation, the market for batteries has drastically changed by a fast growing market of rechargeable lithium-ion battery technologies, by a diversification of chemistries, by a multiplication of applications, and by an increased energy content of these batteries. In the EU Commission Circular Economy Package, batteries and recycling and environment play a significant role. Issues such as extended producer responsibility, extending the product life (re-use and second use), quality of the recycling processes, safety and health and protection of stakeholders handling batteries in production, transport, storage, use, end-of life are being addressed, also in the product environmental footprint, where the reduction of environmental impacts thanks to recycling has been calculated. The real environmental impact, however, may arise from the fraction of batteries that is not taken-back or collected for recycling or being re-used, that is (il)legally exported and processed without the use of adequate technologies...

16:00 - 16:20 Battery Second Life: Redefining the Value Proposition for Stationary Battery Energy Storage Systems

Melissa Bowler, Technical Project Manager, Stationary Battery Storage Systems and B2L, BMW

Innovation is the development or redefinition of value in a new or changing environment. BMW i is an innovative new approach to mobility that is necessary due to the developing context of the world around us. Through the use of integrated services to complement purpose built electric vehicles, the BMW Group has worked to redefine the value proposition of a vehicle to enable a more sustainable form of individual mobility. Through the development of the revolutionary i3 and i8 electric vehicles, it was determined that a conversion was an inefficient partial solution to the challenges of vehicle electrification. To date our experience with Battery Second Use and the use of EV batteries in a stationary application has proven to be no different. Simply using EV batteries in a stationary battery system is novel. Leveraging the USPs of an EV Battery System to realize a higher level of value over the lifecycle of both stationary and mobile applications is revolutionary. This talk will discuss the optimizations and potentials EV Batteries can offer to the stationary storage market.

16:20 - 16:40 Q&A

16:40 - 16:50 Closing Remarks

Hotel & Travel Information

Conference Venue:
Congress Centrum Mainz
Rheingoldhalle
Rheinstraße 66
55116 Mainz, Germany

Host Hotel:
Hilton Mainz
Rheinstrasse 68
55116 Mainz, Germany
T: +49-6131-2450

Discounted Room Rate: **175€**
Discounted Room Rate Cut-off Date: **9 January 2016**

Reservations: Please visit the travel page of **www.AdvancedAutoBat.com** for further details and to book your hotel.

The Market Square in Mainz offers a beautiful view of the Dom.

Located on the Rhine River with a covered corridor connection to the Congress Centrum Mainz, this 4-star hotel offers ideal lodgings for our conference attendees. Only a short walk to Old Town with its famous Dom, elegant shops and restaurants, the Hilton facilities include:

- Generous buffet breakfast
- Rooms with stunning river views
- State of the art gym and sauna
- Casino entertainment

Click Here to Register Online!
SAVE up to €200, Register by 22 January!
AdvancedAutoBat.com

2015 Attendee Profile

AABC is attended by key technologists and business executives from the European xEV energy storage supply chain

Industries Represented

Advanced Battery R&D and Battery Manufacturing	15%
Automaker	15%
Battery Materials	15%
Automotive Components	11%
Academic/University	10%
Electrochemical Capacitors	8%
Specialty & Non-Automotive Battery R&D	5%
Test Equipment	4%
Lead-Acid	4%
Consulting Company	4%
Government & Press	3%
Components, Utilities, Pack Assembly & Fuel Cell	3%
Oil Technology/Chemical Company	2%

Company Type

Commercial	80%
Academic	11%
Services/Societies	7%
Government	1%
Other (Financial/Press)	1%

Geographic Location

Europe	72%
Asia	14%
US	12%
Other	2%

Company Type

Executive/Director	27%
Manager	27%
Scientist/Technologist	21%
Sales/Marketing	16%
Professor	5%
Assistant	4%

Click Here to Register Online!
SAVE up to €200, Register by 22 January!
AdvancedAutoBat.com

Sponsorship & Exhibit Opportunities

Cambridge EnerTech offers diverse sponsorship packages that provide your company the opportunity to showcase your products, services, and solutions to an elite group of delegates. Opportunities include podium presentations within the main agenda, exhibit space, Invitation-Only VIP Dinners, One-on-One Meetings and various branding options. All sponsorship packages are customizable to your company's specific marketing needs and budget.

Exhibit

Exhibitors will enjoy facilitated networking opportunities with qualified delegates. Speak face-to-face with prospective clients and showcase your latest product, service, or solution.

Additional branding and promotional opportunities are available!

For additional information regarding sponsorship or exhibits, please contact:

Sherry Johnson
Manager, Business Development
781.972.1359 | sjohnson@cambridgeenertech.com

Sponsorship Packages

Signature Sponsorship
- Networking Dinner Mixer
- Company logo on lanyards
- Three Main Conference Registrations
- Company video will be displayed on large screen monitor
- Private meeting room for two days

Keystone Sponsorship
- Networking Mixer
- Company logo on lanyards
- Three main conference registrations
- Company Video will be displayed on large screen monitor
- Private meeting room for one day

Diamond Sponsorship
- Choice of Monday Welcome Reception, Ride and Drive, or Battery Pavilion
- Three main conference registrations
- Company Video will be displayed on large screen monitor
- Private meeting room for one day

Platinum Sponsorship
- Choice of Monday Welcome Reception, Luncheon or VIP Dinner (up to 15 guests)
- Two main conference registrations
- Company Video will be displayed on large screen monitor

Past Exhibitors Include:

Advanced Lead Acid Battery Consortium
Arbin Instruments
Argonne National Laboratory
AVL LIST GmbH
BaSyTec GmbH
Chroma ATE Europe BV
Custom Cells Itzehoe GmbH
EL-CELL GmbH
FuelCon AG
HEL LTD.
JSR Micro N.V.
Maccor, Inc.
MAGNA STEYR Battery Systems GmbH
Manz AG
Maxwell Technologies
NETZSCH-Gerätebau GmbH
Nogamigiken Co., Ltd.
Obrist Powertrain GmbH
PEC NV
SAUERESSIG GmbH + Co. KG
Scienlab Electronic Systems GmbH
Sendyne
Shmuel De-Leon Energy, Ltd.
Sovema SpA
Technical University München
The Battery Show
Thermal Hazard Technology
University of Muenster
Wildcat Discovery Technologies

Click Here to Register Online!
SAVE up to €200, Register by 22 January!
AdvancedAutoBat.com

How to Register: AdvancedAutoBat.com

reg@cambridgeenertech.com • P: 781.972.5400 or Toll-free in the U.S. 888.999.6288
Please use keycode AABE F when registering

Pricing and Registration Information

CONFERENCE PRICING

All Access Pricing BEST VALUE!

(Includes Access to Tutorials, Symposia, and Conference)	Commercial	Academic, Government
All Access Advance Registration Rate Until 22 January	€1899	€1619
All Access Late Registration Rate after 22 January	€2099	€1789

Individual Program Pricing

One Tutorial	€439	€439
Two Tutorials	€699	€699
Three Tutorials	€999	€999

** Early registration discounts for tutorials are available. See website for details.*

One Symposium Advance Registration Rate Until 22 January	€899	€769
One Symposium Late Registration Rate After 22 January	€999	€849
Two Symposia Advance Registration Rate Until 22 January	€1399	€1189
Two Symposia Late Registration Rate After 22 January	€1499	€1279
Conference Only Advance Rate Registration Until 22 January	€1399	€1189
Conference Only Late Rate Registration After 22 January	€1499	€1279

25 January	26 January	27-28 January
Battery Simulation (Tutorial 1)	Lithium Battery Chemistry (Symposium 2)	Advanced Automotive Battery Technology, Application & Market Conference • High-Volume Automotive (Track 1) • Industrial and Specialty Automotive (Track 2)
Beyond Lithium-Ion (Tutorial 2)	Battery Engineering (Symposium 3)	
Battery Market (Tutorial 3)		
Electrochemical Capacitors (Symposium 1)		

Group Discount

Groups of 4 or More (must register at the same time) ..... ☐ 15% discount

ADDITIONAL REGISTRATION DETAILS

Poster Submission - Save €150 by presenting a poster at AABC Europe. If you are interested in presenting a poster, please submit your abstract before registering for the event. Abstracts should be sent to **posters@advancedautobat.com** by **7 December 2015**. Once your abstract has been accepted, you will receive instructions to register at our discounted poster registration rate.

Want to Register by Phone?

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

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.

MEDIA PARTNERS