

34th Annual International Battery Seminar and Exhibit 2017

Fort Lauderdale, Florida, USA
20 - 23 March 2017

Volume 2 of 2

ISBN: 978-1-5108-4727-9

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2017) by Cambridge EnerTech
All rights reserved.

Printed by Curran Associates, Inc. (2017)

For permission requests, please contact Cambridge EnerTech
at the address below.

Cambridge EnerTech
Cambridge Innovation institute
250 First Avenue
Suite 300
Needham, MA 02494
USA

Phone: 781-972-5400
Fax: 781-972-5425

ce@cambridgeenertech.com

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

VOLUME 1

PLENARY KEYNOTE PROGRAM

Tesla and the Gigafactory.....	1
<i>K. Kelty</i>	
Surprising Chemistry in Li-ion cells	15
<i>J. Dahn, D. Xiong, L. Ma, K. Nelson, R. Petibon, J. Li</i>	
Charging Forward: Explosive Global Growth in the Battery Industry - Opportunities and Challenges Ahead.....	29
<i>C. Lampe-Onnerud</i>	

POWER APPLICATIONS FOR CONSUMER ELECTRONICS

OEM APPLICATION DRIVEN DEVELOPMENT

Battery Design, Selection and Evaluation for High Criticality Applications - Perspectives from the Medical Device Industry	40
<i>G. Jain, C. Schmidt, H. Ye, E. Scott</i>	
Changes in User Behavior in PC+ Era.....	49
<i>J. Carlson</i>	
Battery Applications for the Home: Diverse Requirements and Possibilities	56
<i>J. Wozniak</i>	
Insights into Optimizing Battery Design to Create Value and Improved Performance for Consumer Products	64
<i>L. King</i>	
Considerations in Adopting Battery Innovation	75
<i>B. Miller</i>	
Simplified Platform Power Measurement Using USB Type-C* Interface to Drive Platform Power Optimization	85
<i>K. Shah</i>	

INNOVATIVE & DESIGN IN NEXT-GEN CONSUMER ELECTRONICS APPLICATIONS

2D Black Phosphorous as a Polysulfide Trapping Agent in Lithium-Sulfur Batteries	98
<i>N. Koratkar</i>	
A Precision Contact Stress Sensor for Monitoring Swelling in Li-Ion Cells	110
<i>J. Kaschmitter</i>	
Unexpected Negative Impact of Additives on Degradation Mechanisms in Commercial Graphite/NMC Lithium-ion Pouch-cells	120
<i>E. Bekaert, F. Aguesse, T. Waldmann, M. Kasper, N. Ghanbari, C. Chabrol, S. Genies, B. Matadi, L. Daniel, M. Wohlfahrt-Mehrens</i>	
3rd Generation Separators: Using Thermally Stable Separators to Turn the Aluminum Current Collector into a Fuse	135
<i>B. Morin</i>	
Strain-Dependent Ion Conductivity of Stretchable Polyethylene Oxide	149
<i>T. Kelly, B. Ghadi, S. Berg, H. Ardebili</i>	
Carbon-Ion™: Safer, Faster Charging Alternative to Lithium-ion Batteries.....	158
<i>C. Resnick</i>	
Transient Electronics: Energy Storage Solutions for Untraceable Applications and Hardware Security	167
<i>R. Montazami</i>	
Development of Microbatteries for Implantable Applications.....	182
<i>Y. Wang, S. Chen, J. Xiao, Z. Deng, J. Zhang</i>	

LITHIUM-ION DEVELOPMENT & COMMERCIALIZATION

R&D: ADVANCING LI-ION CHEMISTRIES

Storage at the Threshold: Li-Ion Batteries and Beyond	192
<i>G. Crabtree</i>	
Controlling the Surface Chemistry of Cathode Materials for Manufacturing High-Energy Rechargeable Batteries	198
<i>F. Lin</i>	

R&D: IMPROVING MATERIALS

Reviving Li Metal Anodes Through Materials Design	213
<i>D. Lin, Y. Cui</i>	
High Rate Lithium Ion Battery Development	231
<i>W. Lu, X. Su, A. Jansen, D. Dees</i>	
Lower Cost Higher Performance Graphite for LIBs	241
<i>E. Buief</i>	
A123's Advanced Material Development for Vehicle Electrification: Low and High Voltage Application Approaches	260
<i>D. Johnson</i>	
Accelerating Development of Advanced Cathode Materials for LIB's	273
<i>D. Strand, B. Li, C. O'Neill, K. Carroll, T. Yi</i>	
Advanced Instrumentation to Study Electrode and Electrochemistry Processes at Different Scales and Frequencies	286
<i>M. Kasper, F. Kienberger</i>	
Laser Applications in Battery Production	294
<i>R. Davis</i>	

R&D: PROTOTYPES, MANUFACTURING & SCALE-UP

Battery Materials Scale-up and Manufacturing Research	304
<i>G. Krumdick</i>	
Solvent-Free Manufacturing of Electrodes for Lithium-Ion Batteries	319
<i>B. Ludwig, I.-M. Chen, H. Pan, J. Liu</i>	
High Performance Li-ion Capacitors	335
<i>B. Cao, J. Yan</i>	

R&D: COST REDUCTION & ENERGY DENSITY IMPROVEMENTS FOR BEVS

Manufacturing R&D for Low-Cost, High-Energy-Density Lithium-Ion Batteries for Transportation Applications	346
<i>D. Wood, Z. Du, M. Wood, J. Li</i>	
How to Significantly Increase Energy Density of Lithium Ion Batteries Without Changing Chemistry?	359
<i>R. Yazami</i>	

ADVANCES IN AUTOMOTIVE POWER APPLICATIONS

BATTERY SAFETY TESTING & REGULATION

Progress in Battery Safety Performance Simulation	384
<i>T. Miller</i>	
Vehicle Technologies Office Electric Vehicle Battery Research Pathways and Key Results	395
<i>D. Howell, T. Duong, B. Cunningham, P. Faguy, S. Gillard</i>	
International Compliance for Portable Device Batteries – What the Heck Do I Have to Do to Ship My Battery To	406
<i>C. Millsaps</i>	

OEM APPLICATION-DRIVE DEVELOPMENT

TOYOTA's Electrification Roadmap	425
<i>M. Lord</i>	
Experimental and Theoretical Developments Necessary for the Use of Silicon Electrodes in Traction Battery Systems	449
<i>M. Verbrugge, X. Xiao, Q. Zhang, M. Balogh, K. Raghunathan, D. Baker</i>	
Advancing Battery Technology for Mercedes-Benz Applications	461
<i>T. Glossmann</i>	
Ultrafast Charging Silicon-Dominant Anode and Li-ion Cell Technology for EV Applications	474
<i>B. Park</i>	
Coslight Li-ion Pouch Power Cell Solution	487
<i>Z. Hai</i>	
Recent Advancements in Lead Battery Performance and New Demonstration Work of ALABC 1618 Program	500
<i>B. Monahov</i>	

INNOVATION & DESIGN IN NEXT-GEN TRANSPORTATION APPLICATIONS

Technology Convergence: Real World Adoption of Vehicle Electrification Strategies	511
<i>C. Rigby</i>	

HIGH PERFORMANCE BATTERY MANUFACTURING

INNOVATION AND DESIGN IN MANUFACTURING

Kinetics of the EDV Li-ion Cells on Electrode Thickness, Porosity and Tortuosity.....	524
<i>Z. Zhang, W. Fang, A. Kasei</i>	
Chinese EV Market & Cathode Materials Used for Automotive LIBs	542
<i>Y. Gao</i>	
Research Progress of Advanced Lithium Ion Polymer Battery Technology	557
<i>P. Cheng</i>	
The Grand Challenge of Advanced Batteries	579
<i>K. Adjemian, B. Liaw</i>	
Towards the Commercialization of High Energy Density Na-ion Batteries	592
<i>J. Barker, R. Heap, N. Roche, C. Tan, R. Sayers, J. Whitley, Y. Lui</i>	
Thermal Management System with Intelligent Temperature Control for Power Battery Pack.....	616
<i>J. Jiang</i>	

ADVANCES IN CELL MANUFACTURING

Cell Finishing - The Understood Cost and Performance Factor	629
<i>R. Goossens</i>	
Lowering Operational Costs During Cell Forming	647
<i>G. Schuster, B. Zollo</i>	
Evaluation of Factory Infrastructure for Advanced Battery Manufacturing	653
<i>A. Halbe</i>	
Saft Group 2017	661
<i>T. Greszler</i>	
Analysis of Li-Ion Battery Joining Technologies*	680
<i>W. Cai</i>	
Status of Chinese EV & EV Batteries - Production, Market and R & D Activities in 2016	695
<i>C. Xiao, X. Liu, Y. Liu, J. Wang</i>	

VOLUME 2

SUPPLY CHAIN SUSTAINABILITY

Lithium Ion Battery Raw Material Supply & Demand 2016-2025	718
<i>C. Pillot</i>	

BATTERY MANAGEMENT SYSTEMS

UNDERSTANDING WEAR & ABUSE

Mechanical Phenomena and Their Effects on Electrochemical Performance in Li-Ion Battery Systems	740
<i>C. Arnold</i>	
Battery Management System Using Stress/Strain Information (Make Stress Work for You).....	759
<i>A. Stefanopoulou</i>	

NOVEL BMS & APPLICATIONS

Redox Shuttle Additives Towards Safer Lithium-ion Batteries.....	782
<i>L. Zhang</i>	
Battery Management System (BMS) Design for Lithium-ion Batteries, A Holistic Approach	792
<i>T. Hoeger</i>	
Battery Cycle Life Extension by Charging Algorithm to Reduce IOT Cost of Ownership	805
<i>N. Matsumura</i>	
Extreme Fast Charging: Technical Gap Assessment	811
<i>C. Michelbacher</i>	

MODELING SAFER BATTERIES

Insights from Safety Tests with an On-Demand Internal Short Circuit Device in 18650 Cells.....	820
<i>E. Darey</i>	
Electric Vehicle Battery Prognostics and Health Management - Mobility and Durability.....	842
<i>J. Lee, M. Rezvani</i>	
Manufacturing R&D for Low-Cost, High-Energy-Density Lithium-Ion Batteries for Transportation Applications.....	858
<i>D. Wood, Z. Du, M. Wood, J. Li</i>	
How to Significantly Increase Energy Density of Lithium Ion Batteries Without Changing Chemistry?.....	871
<i>R. Yazami</i>	

BATTERY SAFETY

BATTERY SAFETY & REGULATION

Progress in Battery Safety Performance Simulation.....	896
<i>T. Miller</i>	
International Compliance for Portable Device Batteries – What the Heck Do I Have to Do to Ship My Battery To.....	907
<i>C. Millsaps</i>	
FedEx Express Shipping Requirements and Safety Mitigation	926
<i>T. Leech</i>	
Encapsulator Agent and Lithium-ion Battery Fires.....	932
<i>J. Bonoski</i>	
Electrification Opportunities in the Transportation Landscape.....	949
<i>C. Robinson</i>	

TOOLS FOR RISK ASSESSMENT & MITIGATION

Modeling Mechanical Failure in Lithium-Ion Batteries	962
<i>S. Santhanagopalan, C. Zhang, C. Yang, A. Wu, L. Cao, A. Pesaran</i>	
Toward developing Safe and High Performance Li-ion Batteries	970
<i>C.-J. Bae</i>	

MODELING FOR SAFETY

Redox Shuttle Additives Towards Safer Lithium-Ion Batteries	987
<i>L. Zhang</i>	
Thermal Propagation in Lithium Ion a Module with and without PCM.....	1001
<i>Q. Li, C. Yang, A. Pesaran</i>	
Spontaneous Ignition of Electric Vehicles After Immersion in Water	1009
<i>H. Mao</i>	

EMERGING ENERGY STORAGE APPLICATIONS

STATIONARY ENERGY STORAGE: GRID APPLICATIONS

Quality Assurance for PV Battery Power Plants and PV Battery Systems in Commercial Applications and Mini-Grids.....	1022
<i>M. Vetter, M. Jantsch</i>	
Integrated Solar Energy Conversion and Redox Flow Battery Devices.....	1038
<i>S. Jin</i>	
Energy Storage Project Perspectives and Case Studies	1050
<i>K. Fok</i>	
Rationally Designed 1D/2D Core/Shell Nanowires for Flexible Supercapacitors	1073
<i>N. Choudhary</i>	

FLOW BATTERIES: DELIVER THE RIGHT CHARGE AT THE RIGHT TIME

Organic Aqueous Flow Batteries for Massive Electrical Energy Storage.....	1083
<i>R. Gordon, A. Aspuru-Guzik, M. Aziz</i>	
Next-Generation Liquid Energy Storage Systems	1097
<i>F. Gibbard</i>	
New Membranes for Aqueous Batteries	1112
<i>M. Hickner</i>	

HYBRID FORMATS FOR ESS

Hybrid Energy Storage Systems at Siemens Mobility Division.....	1133
<i>M. Meinert</i>	
Battery and Mobile Power Grid Safety, Modeling, Simulation, and Advanced Composite Armor	1146
<i>K. Nematollahi</i>	

ALTERNATIVE CHEMISTRIES: DELIVER THE RIGHT CHARGE AT THE RIGHT TIME

Environmental Life Cycle Issues with Perfluorinated Sulfonated Ionomer-Based Fuel Cells	1168
<i>E. Smotkin</i>	
A High Power, Long Cycle Life Sodium-Ion Battery Based on Prussian Blue Electrodes	1178
<i>C. Wessells</i>	
Development of Ni-MH ESS with Lifetime and Performance Estimation Technology	1188
<i>H. Teraoka</i>	

BATTERY DESIGNS FOR UNIQUE APPLICATIONS

Transient Electronics: Energy Storage Solutions for Untraceable Applications and Hardware Security	1207
<i>R. Montazami</i>	
Development of Microbatteries for Implantable Applications.....	1222
<i>Y. Wang, S. Chen, J. Xiao, Z. Deng, J. Zhang</i>	

NEXT-GENERATION BATTERY RESEARCH

INCREASING ENERGY DENSITY WITH ALTERNATIVE CHEMISTRIES

Multivalent Ion As the Next Energy Storage Frontier	1232
<i>B. Ingram</i>	
Breakthrough Energy Storage at ARPA-E	1243
<i>S. Babinec</i>	

INCREASING ENERGY DENSITY WITH MATERIALS

Enhanced Rate Performance in Electrode Materials for Lithium-ion Batteries	1261
<i>J. Billaud, F. Bouville, T. Magrini, F. Bargardi, C. Villevieille, A. Studard</i>	
In-depth Investigation of Process-structureproperty Relationship in Li-ion Battery Cathode Materials	1275
<i>Q. Liu</i>	
Nanocomposites As Next-generation Anode Materials for Lithium Ion Batteries.....	1289
<i>L. Mangolini</i>	
Manufacturing Technology of All-Solid-State Thin-Film Lithium Secondary Battery for IoT Applications	1300
<i>K. Suu</i>	

ADVANCES WITH LI-IONS

Highlights on the Latest Battery Technology Achievements & Challenges.....	1313
<i>S. Patoux</i>	
Advances in the Performance of Lac Knife Natural Flake and Expanded Graphite in Electrochemical Power Sources	1331
<i>J. Doninger, G. Economo</i>	
Advanced Silicon-based LIB Anode	1340
<i>V. Chetveryk</i>	
Advances in Lithium Metal Anode-Based Rechargeable Batteries Utilizing Solid-State Electrolytes	1349
<i>A. Mokrini, A. Laforgue</i>	
Investigation of High-Capacity Ni-Based Layered Oxide Cathodes for Li-Ion Batteries	1362
<i>W. Tong</i>	

ENHANCING PERFORMANCE THROUGH TESTING AND DIAGNOSTICS

Chemical Imaging of High Voltage Cathode Interface	1373
<i>J. Zhou</i>	
Battery Performance Examination Through Collective Battery Parameter Test Analysis.....	1387
<i>D. Kim</i>	
Primary Particle Level Diagnostics by Transmission Electron Microscopy.....	1404
<i>H. Xin</i>	

Revealing Aging Mechanisms in Lithium-Ion Cells 1420
 D. Abraham
Author Index