

## Batteries, Super Capacitors, Fuel Cells & EV's Seminar

July 6<sup>th</sup> – July 8<sup>th</sup> , 2015, Lansing, MI, USA

Shmuel De-Leon and Prof. Doron Aurbach in partnership with XG Sciences invite you to join a unique Batteries, Super Capacitors, Fuel Cells & EV's seminar.

The seminar program focuses on present and future needs of portable and stationary electrochemical energy sources and highlights the latest technological developments designed to satisfy application requirements.

The program reviews state of the art raw materials and technology development (Anode, Cathode, Separator, and electrolyte) as well as primary, rechargeable, reserve batteries, fuel cells, ultra-capacitors systems and their accessories.

The seminar program reviews typical cycle life aspects of designing and manufacturing energy source solutions: from application energy requirements, power source electrical and mechanical design, cells selection, cells evaluation tests, battery prototype, acceptance tests, design and manufacturing techniques, testing, mass production, safety issues, transportation, use and disposal.

Special focus is given to battery design, safety and testing aspects which are vital tools for battery solution.

The program trains attendees on safety issues along the energy source solution cycle life.

The program focuses on electric vehicle and Batteries, Super Capacitors, Fuel Cells and Metal Air systems for EV's.

### Key Benefits

Batteries & Fuel Cells Seminar provides:

- Full review of current and future electrochemical energy sources and state of the art raw materials.
- Training on cells selection, design, manufacturing, testing, safety, and transportation and disposal aspects of energy sources.
- Basic knowledge for new industry members entering the field.
- Expands the knowledge of industry members already working in the field.

### Seminar Program Topics

Cells and up by Shmuel De-Leon

- Battery characteristics
- Primary cells & batteries
- Rechargeable cells & batteries
- Lithium rechargeable cell
- Manufacturing process
- Battery chargers
- Military batteries
- Thermal & reserve batteries
- Battery design process
- Battery safety
- Battery disposal
- The "smart battery"
- Battery testing systems
- Energy storage for the grid
- Fuel cells
- Ultra Capacitors
- The E-Mobility revolution
- xEV's Batteries
- xEV's Fuel Cells and Metal Air systems
- xEV's battery swap
- xEV's Charging infrastructure

Raw materials by Prof. Aurbach

- Basic principles of advanced batteries and super capacitors most important types and how they work
- Review of main battery problems
- Which experiment to select and correctly read basic electrochemical data
- Review anode & cathode materials for Li rechargeable batteries
- Review electrolyte solutions for Li batteries
- Review battery engineering aspects – current collectors, separators, conductive additives
- Review electrodes for super

- Training on Energy Sources Database software – a vital tool for optimal energy source design.

### Who Should Attend?

- Raw material researchers
- Battery and energy sources users
- Pack assemblers
- Cell makers
- Energy sources suppliers
- Academic researchers
- R&D engineers
- Market researchers
- Safety supervisors
- Battery shippers and disposals
- E-Mobility industry members
- Others industry members

capacitors

- Metal air batteries: Challenges, reality & chances for success
- Where we can we go with power sources for EV's? What is the reality and how can we make the EV revolution valid

### Seminar Location

XG Sciences  
3101 Grand Oak Dr.  
Lansing, MI 48911  
[www.xgsciences.com](http://www.xgsciences.com)

### Local Partner

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### About Shmuel De-Leon

Shmuel De-Leon is Founder and CEO of Shmuel De-Leon Energy, Ltd.

Shmuel is a leading international expert in the business of Power Sources, Energy storage and Ev's.

Prior to founding the company, Shmuel held for over 20 years various positions as a power sources, engineering and quality control team manager.

Shmuel holds BSc. in mechanical engineering from Tel-Aviv University and MBA in quality control and reliability engineering from the Technion Institute in Haifa as well as an Electronic Technician's diploma.

Shmuel De-Leon Energy Ltd. provides unique tools for the energy sources industry, such as Consulting, Training, Conference organizer, Market research reports Market research reports Energy Sources Database, Market research reports , Energy Sources Solutions, Industry News weekly newsletter.

### About Prof. Doron Aurbach

DORON AURBACH is a full professor in the department of Chemistry, leading the electrochemistry group (40 people), a senate member at Bar Ilan university (BIU). He chaired the department of chemistry during 2001-2005. Aurbach and his team study the electrochemistry of active metals non-aqueous electrochemical systems, develop spectroscopic methods (in situ and ex situ) for sensitive electrochemical systems, study electrochemical intercalation processes, electrochemical water desalination and develop rechargeable high energy density batteries and EDL capacitors. The group published so far more than 430 peer reviewed papers. D. Aurbach serves as an associate editor in 3 electrochemistry journals: EES, JES (journals of the Electrochemical Society) and J. Solid State Electrochemistry (Springer). He is a fellow of the ECS, ISE and MRS. He is the head of INREP: Israel national research center for electrochemical propulsion and the chairman of the Israeli national authority for labs accreditation. He received the ECS battery division technology award (2005), the Israel vacuum society (IVS) and Israel chemical society (ICS) excellence prizes (2007, 2012), the Landau prize for research towards green energy (2011), the ECS battery division research award and the Kolthoff prize (2013).

**Monday, July 6th, 2015**

<b>08:00 – 08:30 Registration</b>
<b>08:30 – 09:30 Module 1: Battery Characteristics</b> This session introduces a historical prospective of batteries, detailed battery definitions and features (electrical, mechanical, standards, etc.). Module 1 lays the foundation for the attendants to share a common “battery language” and provides all the background needed for upcoming modules.
<b>09:30 – 10:30 Module 2: Primary cells &amp; Batteries</b> This session reviews and compares primary battery chemistries (Alkaline Manganese Dioxide, Zinc Carbon, Zinc Chloride, Silver Zinc, Nickel Oxyhydroxide, Lithium Iron Disulfide, Lithium Iodine, Lithium Manganese Dioxide, Lithium Carbon Monofluoride, Lithium Sulfur Dioxide, Lithium Thionyl Chloride, Lithium Sulfuryl Chloride, Lithium Bromine Chloride and High Power Organic Lithium).
<b>10:30 – 10:45 Coffee Break</b>
<b>10:45 – 12:15 Module 3: Rechargeable cells &amp; batteries</b> This session reviews and compares rechargeable batteries chemistries (Nickel Cadmium, Nickel Metal Hydride, Rechargeable Alkaline, Lithium Ion and Lithium Polymer).
<b>12:15 – 12:35 Module 4: Lithium Rechargeable Cells Manufacturing Process</b> This session reviews manufacturing process techniques for conventional and pouch cells.
<b>12:35 – 13:00 Module 5: Chargers</b> This session reviews battery chargers, charging techniques per battery chemistry, charging problems and solutions, personal chargers, industrial chargers and charger types by charging time.
<b>13:00 – 14:00 Lunch Break</b>
<b>14:00 – 14:30 Module 6: Military Batteries</b> This session reviews and compares Military batteries & Chargers (Primary, Rechargeable Batteries).
<b>14:30 – 15:00 Module 7: Thermal &amp; Reserve Batteries</b> This session reviews and compares Military batteries & Chargers (Primary, Rechargeable Batteries).
<b>15:00 – 16:15 Module 8: Battery Design Process &amp; Optimization</b> This session introduces battery design processes (cell and raw materials selection, cell level testing, battery design documents, battery electrical, mechanical and safety design and final verification tests (electrical, mechanical, safety).
<b>16:15 – 16:30 Coffee Break</b>
<b>16:30 – 18:00 Module 9: Battery Safety</b> This session introduces the safety risks along the battery cycle life and provides safety guidelines for safety event elimination. Module 8 also addresses the procedures involved in handling safety events, including first aid.
<b>Tuesday, July 7th, 2015</b>
<b>08:30 – 09:00 XG Sciences Presentation</b>
<b>09:00 – 09:25 Module 10: Battery Disposal</b> This session introduces battery disposal requirements and updates disposal status in Europe and the US.
<b>09:25 – 09:50 Module 11: The "Smart Batteries"</b> This session introduces the “Smart Battery” technology, including single wire and smart battery communications bus and its advantages.
<b>09:50 – 10:30 Module 12: Battery testing systems</b> This session introduces battery testing techniques, available systems and their features.
<b>10:30 – 10:45 Coffee Break</b>
<b>10:45 – 11:30 Module 13: Energy Storage for the Grid</b> This session introduces and reviews the common energy storage systems for the grid.
<b>11:30 – 12:30 Module 14: Fuel Cells</b> This session reviews and compares fuel cell types and their market status (Alkaline, Molten Carbonate, Phosphoric Acid, Proton Exchange Membrane, Solid Oxide and Direct Methanol).
<b>12:30 – 13:30 Lunch Break</b>

**13:30 – 14:15 Module 15: Ultra Capacitors**

This session reviews and compares ultra capacitor types and their market status.

**14:15 – 16:30 Module 16: EV Energy Solutions**

This session introduces EVs driving range problem and energy solutions.

- The new electric automotive revolution
- EV Batteries
- EV Fuel Cells
- EV Metal Air systems
- EV Battery SWAP
- EV Charging infrastructure

**Wednesday, July 8th, 2015****8:30 – 09:30 Basic Principles of Advanced Batteries and Super Capacitors most important types and how they work**

In this session, we will explain how batteries and super-capacitors work. Review in brief the most important types of batteries: primary, secondary, aqueous, non-aqueous, stationary, flow and more. Some basic principles of electrochemical energy storage & conversion. We will also mention fuel cells in order to complete the picture.

**09:30 -10:30 Review of Main Battery Problems**

The most important components of batteries, their selection and structure including limitations of battery systems in terms of voltage, capacity, energy & power density, and cycling. Failure mechanisms of Li, Li ion, lead acid batteries. Thermal behavior of batteries, possible thermal run-away events. Basic safety matters in production, operation, recycling. Temperature limitations (low, high), impedance development (detrimental surface phenomena) and bulk degradation upon cycling rechargeable batteries.

**10:30 – 10:45 Coffee Break****10:45 -11:45 Which Experiments to Select and Correctly Read Basic Electrochemical Data**

Electrochemical techniques, spectroscopic and microscopic tools for the analysis of batteries and battery components. Basic electrochemical response of electrodes and battery systems. Correct design of experiments. Important techniques such as chrono-amperometry, chrono-potentiometry, cyclic voltammetry, electrochemical titration techniques (PITT, GITT) and impedance spectroscopy.

**11:45 -12:30 Review Anode & Cathode Materials for Li Rechargeable Batteries**

Most important anode and cathode materials for Li and Li ion batteries. Examine characterization tools and routes. Review main structures of Li intercalation compounds: carbons, graphite, lithiated transition metal oxides and Li metal olivines. Examine Li intercalation reactions, Li alloying reactions (e.g. with silicon, tin, binary and ternary metallic compounds and Li conversion reactions as main electrodes reactions in Li ion batteries). Discuss air and sulfur electrodes, in relevance to Li batteries.

**12:30 – 13:30 Lunch Break****13:30 – 14:30 Review Electrolyte Solutions for Li Batteries**

Various aspects of electrolyte solutions for Li batteries: relevant families of non-aqueous solvents, how to choose and how to characterize, relevant Li salts available and the criteria for their selection. Electrochemical windows, ionic conductivity – how it is determined and measured (including temperature effects). Main reactions that limit the electrochemical windows of electrolyte solutions for Li batteries. Possible gas formation, passivation phenomena, thermal reactions and the conditions for electrochemical and thermal stability.

Describe in brief some solid electrolytes: gels, polymeric matrices, ceramic electrolytes.

**14:30 – 15:30 Review Battery Engineering Aspects- Current Collectors, Separators, Conductive Additives**

'Non-reactive' components in batteries: case, current collectors, separators, conducting additives, may be critically important for the good performance of batteries. The right selection of current

collector materials, their stability and involvement in parasitic side reactions. Structures & properties of separators. Main aspects of composite electrodes preparation, the use of various conductive additives and their effect on the passivation properties of the electrodes. Structure-performance correlations, concentrating on engineering aspects.

**15:30 – 15:45 Coffee Break**

**15:45 – 16:30 Review Electrodes for Super Capacitors**

Classify symmetric and a-symmetric capacitors, real electrical double layer capacitors (EDLC) and pseudo-capacitors, in which the electrodes contain surface red-ox moieties. How to prepare and characterize high surface area activated carbon electrodes for EDLC. Aqueous vs. non-aqueous EDLC – advantages and limitations. Relevant electrolyte solutions. Compare batteries and super-capacitors and examine how they complement each other.

**16:30 – 17:00 Metal Air Batteries: Challenges, Reality & Chances for Success**

Review in brief aqueous Al & Zn air batteries. Options to operate Li-air batteries (single or double compartments systems). Experiences accumulated with Li-air batteries, problems and chances for success. Examine the chances to develop rechargeable Li and Na batteries.

**17:00 – 17:30 Where Can We Go with Power Sources for EVs? What is the Reality and How We Can Make the EV Revolution Valid**

This part is a summarizing chapter. We will take into account all the information conveyed to discuss optimization of power sources for EV. Examine how to select the right power sources, the most important parameters, the realistic expectation in terms of performance and how to combine various types of complementary power sources for EV applications.

## Pricing

- \$1499 for 3 days seminar per attendee
- \$999 for Prof. Aurbach 1 day seminar only per attendee
- \$999 for Shmuel De-Leon 2 days seminar only per attendee
- 10% discount for 3+ group attendees
- 10% discount for Government worker attendees (Copy of a valid Government ID required)
- 10% discount for Academic Institute attendees (Copy of an Academic Institute ID required)
- Pricing includes hard copy print out of all seminar presentations and slides, lunch and refreshments
- Special pricing for in-house seminars

## Payment

All payments must be made in U.S. funds drawn on a U.S. bank. Please make check(s) payable to Arbin Instruments and attached to the registration form even if you have registered by phone, fax or e-mail. To guarantee your registration, payment must be received prior to the seminar. Confirmation of your booking will follow.

Payment can also be made electronically using all major credit and debit cards. An extra \$25 processing fee will apply. For all electronic payments, a copy of an electronic invoice will be e-mailed to the e-mail address provided on the Seminar Registration Form.

## Exhibit & Sponsor

Exhibitor and Sponsor will receive:

- 1 roll-up in the seminar room
- Advertisement materials on a side table in the seminar room
- Logo in the seminar program, agenda and seminar web site
- 10% discount on attending the seminar
- Pricing: \$500

### Pre-Registration Form - Energy Storage Seminar July 6<sup>th</sup>-8<sup>th</sup>, 2015

Shmuel De-Leon Energy, Ltd., Mazal Arie 10, Hod-Hasharon 4536045, Israel  
Tel/Fax: 972-77-5010792, Mobile: 972-52-8601517, [www.sdle.co.il](http://www.sdle.co.il), [shmuel@sdle.co.il](mailto:shmuel@sdle.co.il)

Contact Details (*Required)		
Company *	First Name*	Last Name*
Title	City*	Zip Code*
Street*	Country*	State
Phone*	Mobile	Fax
Email*		

\*Please complete the registration form and return to:

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