



The Hebrew University Center  
for Nanoscience & Nanotechnology



# Nano Seminar

## Advanced Materials Science for Energy Storage & Conversion

### Prof. Doron Aurbach

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#### **Abstract:**

It is impossible to imagine modern society without electrochemical power sources. The electronic revolution, which relies on the extensive use of highly sophisticated portable devices such as cellular phones with amazing applications, laptops, video cameras and more, depends on the availability of high-energy density, safe and cheap power sources. Challenges such as electrochemical propulsion by electric vehicles (EV), and the need for large-scale storage of sustainable energy (i.e. load-levelling applications) motivate and stimulate the development of advanced novel rechargeable batteries. Lithium-ion batteries are the focus of intensive R&D efforts because they promise very high energy density that may be suitable for electrical propulsion. In this presentation we review research on batteries with an emphasis on Li-ion battery technology, examining its suitability for EV applications. Batteries (especially when dealing with high energy density systems such as Li batteries) are highly complicated devices: 3 active bulks and 2 active interfaces have to work simultaneously with no side reactions & detrimental reflections. In Li ion batteries there is no thermodynamic stability at both electrodes. Their operation depends on complicated passivation phenomena, which are developed via electrodes-solution reactions.

Consequently, R&D of novel battery system requires to invest great efforts in basic science, in order to understand the correlation among structure, morphology, surface chemistry and electrochemical performance of all the components in the power sources and storage devices. Our approach at BIU: it is important to study all the components alone & together. Use as many tools as possible, electrochemistry, spectroscopy, diffractometry, high resolution microscopy and calorimetry in each single study.

Today we are experiencing a nano revolution that seems to stimulate the introduction and use of nano-materials in all possible areas of technology and medicine. This presentation will discuss also the relevance of nano-materials to the field of high energy density batteries.

#### **References:**

- [1]. Li-sulfur batteries: Markevich, E.; Salitra, G.; Rosenman, A.; Garsuch, A.; Aurbach, D.; "Review on Li-Sulfur Battery Systems, an Integral Perspective", *Advanced Energy Materials*, 5, article number 1500212 (2015).
- [2]. Beyond Li on batteries: Choi, J W.; Aurbach, D.; "Promise and reality of post-lithium-ion batteries with high energy densities", *Nature Reviews Materials*, 1, 16013 (2016).
- [3]. Li oxygen batteries: Aurbach, D.; McCloskey, B.; Nazar, L.F.; Bruce, P. "Advances in Understanding Mechanisms Underpinning Lithium-Air Batteries", *Nature Energy*, 1, Sept., 2016

#### **Gathering & Refreshments at 10:50**

Please contact Alexandra Bannykh at 6584919 if you are interested in meeting the lecturer.

**Tuesday, Feb 21<sup>st</sup> 2017, 11:00 at the Seminar Hall**

Los Angeles Building, entrance floor.