

# T<sub>C</sub>SUH Bi-Weekly Seminar

Texas Center for Superconductivity at the University of Houston

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Department of Mechanical Engineering and

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**Friday, March 30, 2012**

**Room, 102, University of Houston Science Center**

**12:00 noon – 1:00 p.m.**

## Hybrid Ion Conducting Nanofillers for Solid Polymer Electrolytes in Lithium Ion Batteries

### ABSTRACT

There is a growing shift from liquid towards polymer electrolytes due to many advantages of polymers including enhanced safety and flexibility. However, ionic conductivity of polymers can be orders of magnitude lower than that of liquid electrolytes. Nanoscale fillers are known to enhance the Li ion conductivity as well as improve the mechanical properties of the polymer electrolytes. Carbon nanotubes (CNTs) can be highly effective in improving the mechanical properties of the polymer but are electrically conductive and can pose the risk of shorting in batteries. In this study, we show that carbon nanotubes grown and packaged within clay layers can work as effective hybrid 3D nanofillers as the nanotubes are electrically insulated by the clays. We show, for the first time, that such hybrid nanofillers improve the Li ion conductivity of PEO electrolyte by almost two orders of magnitude. Furthermore, the incorporation of only 5% clay-nanotube hybrid particles leads to 160% increase in the tensile strength of the polymer electrolyte. The mechanism of ion conductivity enhancement can be attributed to the high surface density of the 3D hybrid fillers and the strong interaction between the CNT's rich negative electron cloud and positive lithium ions.

### BIO

Dr. Haleh Ardebili has a BS honors degree in Engineering Science and Mechanics from Pennsylvania State University at University Park, MS degree in Mechanical Engineering from Johns Hopkins University and PhD degree in Mechanical Engineering from University of Maryland at College Park. She has three years of industry experience as research scientist at General Electric Global Research Center at Niskayuna, New York. She is a recipient of Invention Fulcrum of Progress Award from GE for a patent on direct CSI scintillator coating that led to significant improvement in the performance of medical digital X-ray detectors. She has six years of experience teaching at University of Houston. Dr. Ardebili is a co-author of a book titled *Encapsulation Technologies for Electronic Applications* published by Elsevier in 2009. From 2009 to 2010, she was a postdoctoral research fellow at Rice University in Prof. P.M. Ajayan's group. In Sep 2010, she joined as Assistant Professor in the Mechanical Engineering Department at UH. Her research work is mainly focused on nanomaterials for energy storage and electronics



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