T_CSUH Bi-Weekly Seminar

Texas Center for Superconductivity at the University of Houston

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Flexible Lithium Ion Batteries based on Solid Polymer Electrolyte

ABSTRACT

The prevalence of flexible electronics, evident by the ubiquitous touch-screens, roll-up displays, wearable sensors and implantable medical devices, has brought attention to the development of high performance and safer flexible energy storage devices. A major milestone in the development of the all-solid-state flexible LIB is the replacement of the traditional organic liquid electrolyte with high performance solid electrolyte, namely, ceramic/glass or polymer.

In this study, we have developed a high performance flexible Li ion battery based on a solid nanocomposite polymer electrolyte (1% graphene oxide particles in polyethylene oxide host) exhibiting a capacity of 0.13 mAh cm^{-2} and excellent cycling stability over 100 charge/discharge cycles. Improvement in ion conductivity is observed with the addition of only 1 wt.% graphene oxide filler to the polymer electrolyte demonstrated by complex impedance spectra. The flexible LIB displays a relatively higher maximum operating voltage of 4.9 V compared to that of conventional batteries based on liquid electrolyte. Furthermore, the energy density of the fabricated flexible LIB is measured to be 4.8 mWh cm^{-3} at room temperature which is within the range of reported energy densities of thin film LIBs (1-10 mWh cm^{-3}). The laminated battery shows robust mechanical flexibility over 6000 bending cycles and excellent electrochemical performance in both flat and bent configurations. Finite element analysis (FEA) of the LIB provides critical insights into the evolution of mechanical stresses during lamination and bending.

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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