MRS-T 中國材料科學學會
Materials Research Society-Taiwan

Invited speaker's information form of IUMRS-ICA2017

Presentation on Symposium of "smart materials (D7)"

Presentation title: In Situ Investigations of Nanowires for Energy Storage and Smart Material Applications

Speaker's name and affiliation: S.T. Boles, Dept of Electrical Engineering, The Hong Kong Polytechnic University

City/ Country: Hong Kong

Email: steven.t.boles@polyu.edu.hk

Brief biography of Speaker:

Steven Boles received BS degree in Materials Science and Engineering from Carnegie Mellon University in 2004, and Ph.D. degree in Materials Science and Engineering from the Massachusetts Institute of Technology in 2010. He is currently an assistant professor in the Department of Electrical Engineering at the Hong Kong Polytechnic University. His research interests cover the characterization and development of advanced electronic materials for a variety of energy-focused applications.

Abstract:

Nanowires are often considered to be a core component for the next generation of electronic devices. However, the unique geometry and size-scale of nanowires makes them particularly attractive for discovering and exploring fundamental material properties which are not exclusively inherent to nanowires, but rather are also exhibited in micro- and bulk-specimens. In this work, silicon and other semiconductor nanowires are used a platform for in situ scanning electron microscopy investigations of energy-related materials and applications. In particular, single-crystal silicon nanowires grown using the vapor-liquid-solid technique provide new insights into the electrochemical alloying process which occurs inside lithium-ion batteries. Using our platform, potentiostatic control of lithiation can yield information about the nature of transformation in silicon-based anodes. Furthermore, these same nanowires can be mechanically investigated to determine their basic mechanical properties, such as elastic modulus, fracture strength and creep behavior. Findings from these investigations will be discussed. In situ mechanical studies can also be coupled with real-time electrical measurements. Coupled electro-mechanical testing of vanadium dioxide nanowires confirms the stress-induced phase change in this correlated electron material. The change between the two metal phases of the material is clearly coupled with a change in the material resistivity, which may be of interest for new, smart material applications. Lastly, new investigations and research directions based on the testing platform and methods previously described will be presented.

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