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Materials for a Carbon-free Future: An *in situ* Study of Interfaces and Defects in Next Generation Device Applications

Date : Wednesday, March 2, 2016

Time : 6:00 pm – 7:00pm

Location : Guyon Auditorium

Abstract: World demand for energy is projected to more than double by 2050 and more than triple by the end of the century. However, as the result of the 2015 Paris Climate Conference (COP21), the industrial emissions of greenhouse gases, mostly the results of energy production, will have to come to an end by roughly 2050. New affordable and sustainable clean energy sources will therefore be needed to meet this demand. Innovative approaches are required to store excess energy and level intermittent production of renewable energy sources. The development of new materials with improved efficiencies and stabilities at lower costs than today's standards are necessary to meet the requirements and ensure a sustainable carbon-free energy future. In this presentation, I will present a multi-scale approach towards developing new materials for energy conversion, energy storage and transportation. By combining advanced materials synthesis with atomic-scale characterization and first-principles modeling, I will demonstrate the effects of grain boundaries in limiting the conversion efficiency in thin-film solar-cells and thermo-electrics. I will also discuss our recent discoveries in high-efficiency battery cathode and anode materials using state-of-the-art in-situ scanning transmission electron microscopy.

Dr. Robert F. Klie focusses on Z-contrast imaging, electron energy-loss spectroscopy (EELS) and in-situ characterization of energy materials. Dr. Klie started his undergraduate education at the Max-Planck-Institute for Radio Astronomy at the Friedrich-Wilhelm-University in Bonn, Germany, and graduated with a PhD in Physics from the University of Illinois at Chicago. He currently holds an appointment as an Associate Professor in the Physics Department at the University of Illinois at Chicago, where he has pioneered in-situ heating and cooling experiments using atomic Z-contrast imaging and EELS of oxide grain boundaries, heterogeneous catalysts, as well as semiconductor thin-films. As a scientist, Dr. Klie has over 10 years of experience in academic and industrial research, including his appointments previous appointment as a Goldhaber Fellow at Brookhaven National Laboratory.