UCF | Materials Science and Engineering

UNIVERSITY OF CENTRAL FLORIDA

MATERIALS SCIENCE & ENGINEERING DISTINGUISHED SEMINAR SERIES

Prof. Bryan D. Huey

Head of Materials Science and Engineering Department

2nd Vice-Chair University Materials Council

University of Connecticut

Friday
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Zoom

Meeting Room

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The College of Graduate Studies

Three Dimensional Nanoscale Properties for Photovoltaic and Functional Thin Films

Nano- and meso- scale materials properties are crucial to the macroscopic performance of a wide range of functional and photovoltaic devices. Investigations of photoconductivity, ferroelectricity, and even domain dynamics with Atomic Force Microscopy are especially insightful for elucidating the influence of grain boundaries, orientation, strain, and other microstructural defects or heterogeneities. However, practical devices are often sensitive to, or even controlled by, sub-surface effects or thickness dependencies related to microstructure and concentration, polarization, or field gradients. Therefore, we are advancing Tomographic AFM for volumetric materials property mapping, with voxels of properties approaching 10 nm^3. With polycrystalline photovoltaics such as $MAPbI_3$ and CdTe, TAFM literally uncovers new pathways to improve carrier separation via inter- and intra-granular defects (Luria, Nature Energy, 2017; Song, Nature Communications, 2020). For $BiFeO_3$, Tomographic AFM confirms Kay-Dunn thickness scaling, LGD behavior with a minimum switchable thickness of <5 nm, distinct properties for superlattices with <7nm layers, and even co-located domain and current maps which together directly reveal sub-surface topological defects (Steffes, PNAS, 2018). Such volumetric insight is increasingly important for engineering optimal performance and reliability of real-world, 3-dimensional materials devices.

Biography: Bryan Huey, Professor and Department Head for MSE at UConn, is also the 2nd vice-chair (chair in 2023) for the UMC (association of MSE department heads). He is the past chair of the 1200 person Basic Science Division of the American Ceramic Society, was one of five overall organizers for the 7000 attendee 2019 MRS Fall Meeting, and co-organized previous EMA and US-Japan Dielectrics conferences as well. He is an expert in the development and application of advanced variations of Atomic Force Microscopy for studying piezoelectrics, multiferroics, photovoltaics, MEMS, and biological cells and tissue. This includes simultaneous AFM and 3d fluorescence, high speed AFM, and a particular recent focus on Tomographic AFM.