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Bryan Huey is an Associate Professor at the University of Connecticut. He is also the past chair of the 1200 person strong Basic Science Division of the American Ceramic Society. 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. He attended Stanford University for a B.S. and the University of Pennsylvania for a Ph.D. in Materials Science, followed by 3 years at Oxford University and 2 years at the National Institutes of Standards and Technology before joining UConn in 2004.

Will lecture on:

Nanoscale Performance of Functional Ceramics and Solar Cells

Interfacial properties are fundamental for functional devices such as piezoelectrics, multiferroics, and solar cells. To directly investigate such effects at the nanoscale, we have developed High Speed, Tomographic, and other variations of SPM. For piezoelectrics, substantial variations in converse-piezoelectric coefficients and sometimes also hysteresis loops are discovered at the strain relieved edges of micropatterned islands and for piezoelectric fibers. With ferroelectrics, movies of the domain switching process in PZT reveal enhanced or diminished nucleation and growth at grain boundaries and other microstructural defects. In similar studies with poly-domain BiFeO₃ multiferroics, a stepwise switching process was also directly detected for the first time. Somewhat surprisingly, this favors multiple 71° ferroelastic/ferroelectric polarization changes instead of single, pure ferroelectric, 180° switches—a concept recently leveraged to develop a new magnetoelectric switch, featured in Nature (Heron et. al., 2014). Finally, with polycrystalline solar cells, photocurrent is mapped as a function of both position and depth for 0.5-5 suns of illumination. Novel photovoltaic performance maps reveal tremendous heterogeneity in CdTe polycrystalline solar cell films, while tomographic measurements uniquely identify photocurrents as a function of depth and microstructure with unprecedented resolution in 3 dimensions. These results indicate enhancements for certain grains, suggest a strong influence of grain and boundary mediated current percolation pathways, and directly indicate that planar defects such as twins and stacking faults may enhance solar cell efficiency by providing orthogonal channels for hole transport.

Monday, March 14, 2016, 13:30

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