Materials Science & Engineering Seminar Series

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The Science and Engineering of Functional Complex Oxide Thin Films – Designing Next-Generation, High Performance Materials

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Abstract: Complex oxide materials possess a range of interesting properties and phenomena that make them candidates for next-generation devices and applications. But before these materials can be integrated into state-of-the-art devices, it is important to understand how to control and engineer the response of these materials in a deterministic manner. In this talk we will discuss the science and engineering of thin-film versions of these materials. We will explore the role of the epitaxial thin-film growth process and the use new types of lattice mismatch strain to engineer a range of systems with special attention to ferroelectric materials. In recent years, the use of epitaxial strain has enabled the production of model versions of these complicated materials and the subsequent deterministic study of field-dependent response. Here, we will investigate how new manifestations of epitaxial constraint can enhance electric field, stress, and temperature susceptibilities (*i.e.*, dielectric, piezoelectric, pyroelectric, and electrocaloric effects) in ferroelectrics. In particular, we will explore a number of routes to push the boundaries of modern thin-film strain to control materials including (but not limited to): 1) the production and use of strain gradients in compositionally-graded materials, 2) the use of film orientation to produce exotic domain structures and responses, and 3) a new “defect strain” pathway to push the limits of strain control of materials. The discussion will range from the development of a fundamental understanding of the physics that lies at the heart of the observed effects, to an illustration of routes to manipulate and control these effects, to the demonstration of solid-state devices based on these materials

Bio: Professor Lane W. Martin is an Associate Professor of Materials Science and Engineering and a Faculty Scientist in the Materials Science Division at Lawrence Berkeley National Laboratory. Lane received his B. S. in Materials Science and Engineering from Carnegie Mellon University in Dec. 2003 and his M. S. and Ph.D. in Materials Science and Engineering from the University of California, Berkeley in 2006 and 2008, respectively. From 2008 to 2009, Lane served as a Postdoctoral Fellow in the Quantum Materials Program, Materials Science Division, Lawrence Berkeley National Laboratory. From 2009 to 2014, Lane was an Assistant Professor in the Department of Materials Science and Engineering at the University of Illinois, Urbana-Champaign. In 2014, Lane returned to the University of California, Berkeley as an Associate Professor. Lane has published >122 papers and his work has been cited >6,715 times. Lane’s work has garnered a number of awards including the American Association for Crystal Growth (AACG) Young Author Award (2015), the Presidential Early Career Award for Scientists and Engineers (2014), the Dean’s Award for Research Excellence for the University of Illinois, Urbana-Champaign (2013), the National Science Foundation CAREER Award (2012), the Army Research Office Young Investigator Program Award (2010), a National Science Foundation IGERT Fellowship in Nanoscale Science and Engineering (2004-2007), the Intel Robert Noyce Fellowship in Microelectronics (2007-2008), the Graduate Excellence in Materials Science Award (2006), and the Materials Research Society’s Gold Medal Award for Graduate Students (2006).

Doherty Hall 2210, 11:30AM
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