

Carnegie Mellon University

Materials Science & Engineering

presents

Combinatorial Approach to Materials Discovery

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ABSTRACT:

Throughout the history of mankind, scientists and engineers have relied on the slow and serendipitous trial-and-error approach for materials discovery. In 1990s, the combinatorial approach was pioneered in the pharmaceutical industry in order to dramatically increase the rate at which new chemicals are identified. The high-throughput concept is now widely implemented in a variety of fields in materials science. We have developed combinatorial thin film synthesis and characterization techniques in order to perform rapid survey of previously unexplored materials phase space in search of new inorganic functional materials. Various thin film deposition schemes including pulsed laser deposition, electron-beam deposition, and co-sputtering are implemented for fabricating massive arrays of compositionally varying samples on individual combinatorial libraries. A suite of high-throughput characterization tools are employed to screen the combinatorial libraries and map different physical properties of materials as a function of sweeping composition changes. They include room-temperature scanning SQUID microscopy, microwave microscopy, and micromachined MEMS cantilever arrays. Advanced characterization techniques at synchrotron beam lines are used for rapid diffraction as well as x-ray magnetic circular dichroism measurements. I will discuss our recent work on data driven strategies to discovery and integration of the combinatorial experimental approach with theory as well as machine learning.

BIOGRAPHY:

Ichiro Takeuchi is a professor of materials science and engineering and an affiliate professor of physics at the University of Maryland. He received his B.S. in physics from California Institute of Technology and Ph.D. in physics from the University of Maryland. Takeuchi spent three years as a postdoctoral associate at Lawrence Berkeley National Laboratory before joining the faculty of the University of Maryland in 1999. He is an APS fellow. Takeuchi's research interests include combinatorial materials science, solid state cooling, and multilayer thin films and devices.

**Doherty Hall 2210, 11:30AM
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