

**Subject:** MS Colloquium- 12/15/05-Fong, Bldg. 212, Room A157  
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## MATERIALS SCIENCE COLLOQUIUM

**SPEAKER:** Dr. Dillon Fong  
Argonne National Laboratory  
Materials Science Division and the Center for Nanoscale Materials

**TITLE:** In Situ Synchrotron X-Ray Studies of Crystal-Vapor Interactions

**DATE:** Thursday, December 15, 2005

**TIME:** 11:00 a.m.

**PLACE:** Building 212, Room A157

**HOST:** Paul Fuoss

Refreshments will be served at 10:45 a.m.

Abstract. The structure of crystal surfaces can be investigated with grazing incidence x-ray scattering in both vacuum and high pressure/reactive environments. Two quartz-walled reaction chambers specially constructed to mount onto surface diffractometers at the Advanced Photon Source allow in situ monitoring of the crystal surface in equilibrium with the vapor phase at temperatures from 25 to 1000°C. In this talk, I will discuss the thermodynamic and kinetic behavior of two very different crystal-vapor systems: single crystal Cu and oxygen, and single crystal PbTiO<sub>3</sub> and PbO. In the case of Cu and oxygen, the equilibrium phase boundary between Cu and the Cu<sub>2</sub>O is observed to be at several orders-of-magnitude larger oxygen partial pressures than predicted by bulk thermodynamics. For the PbTiO<sub>3</sub> and PbO, we find that the PbO vapor pressure has a significant effect on the ferroelectric behavior of PbTiO<sub>3</sub>. Recent experiments on the interactions between nanostructures (nanoislands or nanodomains) and the vapor phase will also be discussed.