Subject: MATERIALS SCIENCE COLLOQUIUM, Wacek Swiech, Univ, of IL. at Urbana-Champaign, Diffusion at Surfaces: From Quasi-Equilibrium at Elevated Temperatures to Evolution Driven by Variable-Energy Ion Beams", Thursday, February 21, 2008,11:00am, Bldg. 212, A-157
From: Marlene Metz <metz@anl.gov>
Date: Fri, 08 Feb 2008 16:45:41 -0600
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MATERIALS SCIENCE COLLOQUIUM

SPEAKER: Wacek Swiech
University of Illinois at Urbana-Champaign

TITLE: "Diffusion at Surfaces: From Quasi-Equilibrium at Elevated Temperatures to Evolution Driven by Variable-Energy Ion Beams"

DATE: Thursday, February 21, 2008

TIME: 11:00 a.m.

PLACE: Building 212, Room A-157

HOST: Michael Pierce

Refreshments will be available at 10:45 a.m

Abstract: The synthesis and properties of nanostructures depend among others on behavior related to the kinetics and energetics of surface thermal defects. Kinetics on surfaces is largely determined by the surface mass diffusion coefficient. This information can be accessed by various surface sensitive microscopies, e.g. low-energy electron microscopy (LEEM). Using LEEM we investigated the near-equilibrium dynamics of surface-terminated dislocations. We observe, in real-time, the thermally-driven nucleation and shape-preserving growth of spiral steps rotating at constant temperature-dependent angular velocities around cores of dislocations terminating on the TiN(111) surface in the absence of applied external stress or net mass change by deposition or evaporation. Furthermore, we have employed LEEM to derive a detailed understanding of the kinetics of thermal sublimation of Cr(001). Spontaneous nucleation and growth of vacancy islands, rotation of spiral steps, and decay of islands are analyzed to yield information about surface energetics. Since step recession is the main mechanism through which atomic layers are removed, the surface remains fairly smooth after many atomic layers are removed. Low-energy ion irradiation has proven to offer the unique capability of stimulating surface diffusion processes even while bulk diffusion is decreased by operating at reduced temperatures. For various research interests ion beams provide an opportunity to probe the equilibrium behavior of the surface system of thermal point defects (i.e. adatoms, advacancies, surface mass diffusion, etc.) and also to observe its response when driven by ion beam irradiation. Our LEEM instrument has been modified to incorporate a variable-energy ion beam source such that the behavior of surface structures like step edges can

be observed at video rates in real time during actual ion irradiation, and down to very low ion impact energies that are needed if surface damage is to be minimized. Examples of real-time imaging of Pt(111) surface evolution driven by variable-energy self-ion irradiation will be presented.

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