Subject: MSD Colloquium, Lucovsky, Thurs, 4/5, 11am, 212, A-157
From: Suzanne Kokosz <kokosz@anl.gov>
Date: Tue, 20 Mar 2007 07:49:46 -0500
To: Materials Science Division <msd@anl.gov>

SPEAKER: Dr. Gerry Lucovsky
Department of Physics
NC State University

TITLE: Spectroscopic Detection of Chemical Bonding Self-Organization Length Scales, ls, in Non-crystalline and Nano-crystalline Thin Films: low defect density materials for device applications

DATE: Thursday, April 5, 2007

TIME: 11:00 a.m.

PLACE: Building 212, Room A157

HOST: Orlando Auciello

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

Abstract: This talk identifies different length scales, ls, for strain-reducing chemical bonding self-organizations (CBSO) in non-crystalline and nano-crystalline thin films. CBSOs are differentiated spectroscopically, and explained by semi-empirical bond-constraint theory (SE-BCT). Non-crystalline thin film CBSOs are characterized by molecular scale strain-reducing chemical ordering with ls >0.6 nm and extending to at most 1 nm. The non-statistical bonding results in reduced defect densities that are enabling for device applications. Nano-crystalline thin films display qualitatively different properties in two distinct nano-scale regimes in which the metric is the primitive unit cell size: i) type I with nano-grain dimensions and ls ~2 nm, and ii) type 2 with nano-grain sizes and ls > 3-4 nm. There are also diphasic nano-crystalline/non-crystalline technologically important thin films in which strain percolation is also minimized by CBSOs that combine molecular and PUC scales of order. Representative non-crystalline, nano-crystalline and diphasic nano-crystalline/non-crystalline thin film materials with qualitatively different behaviors and degrees of phase stability/metastability are addressed. These include: i) non-crystalline gate dielectrics for a-Si(H) thin film transistors (TFTs), and Si and Ge field effect transistors (FETs), ii) nano-crystalline gate dielectrics for Si, Ge and other semiconductor field effect transistors (FETs). iii) non-crystalline a-Si(H) and a-Se(As,Cl) for large area photovoltaic and photoconductive applications, and iv) non-crystalline, and diphasic nano-crystalline/non-crystalline thin films for phase change optical memories for CDs and DVDs.