

Center for Nanophase Materials Sciences (CNMS)



CNMS DISCOVERY SEMINAR SERIES

Joint Meeting with the

MATERIALS SCIENCE AND TECHNOLOGY DIVISION

Friday, October 6, 2006

11:00 am

Iran Thomas Lecture Hall (8600, Aud.)

Refreshments will be served at 10:45 am

“The One-Two Punch: Synergisms arising from combined mechanical and chemical stimuli at the nanometer size scale”



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Abstract: Bond breaking at surfaces during exposure to energetic particles and waves (electrons, ions, photons), to mechanical stresses, and to chemical agents is well established. We show that applying multiple stimuli (the “one-two punch”) often produce synergetic effects, where material removal or modification far exceeds the effect of either stimulus alone. We show the nanometer-scale consequences of applying localized mechanical stress (due to sliding contact with the tip of an atomic force microscope—AFM) to slightly soluble inorganic crystals in the presence of aqueous solutions. We are studying the details of nanoscale tribochemistry, with emphasis on tip-induced tribochemical material removal, recrystallization (at low contact forces), and modification. We also present results on the modification of polymer surfaces during AFM scanning in organic solvents. We show a new method for introducing small amounts of chemicals in highly localized patches along a polymer surface. Finally, if time allows, we show evidence for a “1-2-3 punch,” where we introduce radiation as a third stimulus on inorganic crystal surfaces. These results have possible applications in sensors, nanofluidics, and optoelectronics. Models will be presented to explain the observed nanometer-scale surface modification.

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