Monash e-Research Centre

Thursday 23 June 2011
JOINT TELE-SEMINAR

Department of Materials Engineering of Monash University
and the Department of Materials Engineering of the Technion, Haifa, Israel
'Nanomechanics of gold microcrystals: A combined experimental and atomistic simulation study' , by Prof. Eugene Rabkin - *Biography: http://materials.technion.ac.il/rabkin.html*

Time: 4 - 5pm
Location: Room 135, Bldg 26, Clayton Campus
Visit: http://www.monash.edu.au/eresearch/events/index.html

This is the first seminar as part of a new collaboration between the Technion and Monash University, and is supported by the Victorian Technion Society and Monash. Over coming months we will transmit seminars by experts at the Technion and Monash on a range of topics of mutual interest, with the goal of fostering closer research ties and collaboration. Leveraging existing equipment and expertise at Monash, the Victorian Technion Society has funded the installation of similar equipment in Israel, supporting high definition video between the two universities.

It is also planned to extend the successful Monash Undergraduate Research Projects Abroad (MURPA) scheme that allows students to engage in a summer research internship overseas. It is hoped that up to two Monash students will be sent to the Technion in 2012 as part of the MURPA scheme. The seminar will highlight potential mentors and research groups that are willing to host students.

Abstract:
We employed a solid state de-wetting technique to produce an array of faceted single crystalline Au particles of sub-micrometer dimensions on the sapphire substrate. The microparticles were tested in compression employing the depth-sensing indentation instruments equipped with the sharp "cube corner" and flat diamond tips. The nanoindentation tests performed with cube corner indenter revealed that plastic deformation compliance of the particles increases with decreasing particles size. Gold thin films of comparable thickness exhibited much higher resistance to plastic deformation than the particles. By contrast, during the nanoindentation tests performed with the flat diamond punch, small particles exhibited higher yield strength than their large counterparts (smaller is stronger). To understand these differences in the indentation behavior of the microparticles and thin films, we performed atomistic molecular dynamic simulations of the indentation process. The simulations showed that in the case of cube corner indenter the dislocations are nucleated at the interface between the indenter and the particles/films, while in the case of flat punch the nucleation occurs at the corners of the upper particle facet. The dislocations in the particles were short-lived and did not form complex dislocation structures before annihilating at the free surfaces. In the thin film the dislocations accumulated around and beneath the indenter, resulting in complex, sessile dislocation structures contributing to film hardening. We proposed a stress-gradient dislocation nucleation model relating the indentation size effect to stress gradients in the particle along the slip plane.

MONASH University

Go Boldly.