

## Seminar

Date: 4 June 2009 (Thursday)  
Time: 11:00 am - 12:00 pm  
Venue: EF 305, The Hong Kong Polytechnic University

### Nanomechanics Research at HKU

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#### Abstract:

In multiple scientific disciplines, there is an increasing need to understand the mechanical behaviour of materials and structural units of sub-micron to nanometric dimensions. In physical sciences and engineering, devices are being designed to function with submicron sized material structures, and so their reliability depends critically on an accurate understanding of the behaviour of these materials and structures at the length scale concerned. In biological and medical disciplines, efforts are being made to correlate the mechanical properties of “small” building units of biological tissues with their functions and pathological changes, in an attempt to understand the nature of the relevant diseases.

“Nanomechanics” has been a key component of the HKU Strategic Research Theme on Bio-nanotechnology, and this talk will showcase some of the corresponding research activities. The major part of this talk will focus on the plastic deformation of small engineering materials. Whereas the deformation of bulk materials are smooth and continuous, recent experiments on crystalline specimens of micron or sub-micron dimensions reveal that their plastic flow is jerky, with large sporadic strain bursts typically up to a few %. Conventional constitutive relations for bulk materials cannot describe such bursts – the plasticity of small crystals simply needs another description. After a review of the corresponding experimental observations, statistical models will be proposed which can satisfactorily describe the stochastic and jerky nature of deformation of these micro-crystals.

As an epilogue to this talk, a short introduction to some current efforts of using nanomechanical techniques to study biological specimens will be given. These include using the focused-ion-beam/nanoindentation technique to study the micron-scale properties of biological tissues, as well as the development of appropriate nanoindentation techniques to cater for the usually very soft and wet biological tissues.

#### Biosketch:

Professor A.H.W. Ngan obtained his PhD on electron microscopy of intermetallics in 1992 at the University of Birmingham, under the supervision of Professor R.E. Smallman, FRS, FEng, CBE. He then carried out postdoctoral research at Oxford University on materials simulations under the supervision of Professor D.G. Pettifor, FRS. In 1993, he returned to the University of Hong Kong as a Lecturer in materials science and solid mechanics. In 2003, he was promoted to Senior Lecturer and in 2006 Professor. His research interests include dislocation theory, electron microscopy of materials, and more recently, nanomechanics. He has published over 100 papers in reputable journals. He received a number of awards including the Williamson Prize (for being the top Engineering graduate at the University of Hong Kong), Thomas Turner Research Prize (for the quality of PhD thesis at the University of Birmingham), Outstanding Young Researcher Award and Outstanding Research Award at the University of Hong Kong, a higher doctorate (DSc) from the University of Birmingham, Rosenhain Medal from the Institute of Materials, Croucher Senior Research Fellowship, etc. He co-authored a textbook “Physical Metallurgy and Advanced Materials” with R.E. Smallman, published by Elsevier.

\* Refreshment will be served after the seminar.