

Carnegie Mellon

Materials Science and Engineering Seminar Series

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“SIZE MATTERS: Nano-scale Mechanical Properties of Crystals”

Friday, October 26, 2007

11:00 A.M. Seminar in Hamerschlag B131

While “super-sizing” seems to be the driving force of our food industry, the direction of materials research has been quite the opposite: the dimensions of most technological devices are getting ever smaller. These advances in nanotechnology have a tremendous impact on parts of the economy as diverse as information, energy, health, agriculture, security, and transportation. Some of the examples include data storage at densities greater than one terabit per square inch, high-efficiency solid-state engines, single-cell diagnostics of complex diseases (e.g. cancer), and the development of ultra-light yet super-strong materials for vehicles, with the component sizes comprising these technological devices reduced to the sub-micron scale. The functionality of these devices directly depends on their structural integrity and mechanical stability, driving the necessity *to understand* and *to predict* mechanical properties of materials at reduced dimensions. Yield and fracture strengths, for example, have been found to deviate from classical mechanics laws and therefore can no longer be inferred from the bulk response or from the literature. Unfortunately, the few existing experimental techniques for assessing mechanical properties at that scale are insufficient, not easily accessible, and are generally limited to thin films. In order to design reliable devices, a fundamental understanding of mechanical properties as a function of feature size is desperately needed; with the key remaining question whether materials really are stronger when the instrumental artifacts are removed, and if so then *why* and *how*.

Julia R. Greer received her S.B. degree in Chemical Engineering with a minor in Advanced Music Performance from Massachusetts Institute of Technology (1997) and Ph.D. degree in Materials Science and Engineering from Stanford University (2005). She has also worked at Intel Corporation in a mask micro-fabrication facility (2000-03) and was a post-doctoral fellow at the Palo Alto Research Center, PARC (2005-07), where she studied organic flexible electronics. Greer is a recipient of the gold Materials Research Society Graduate Student Award (2004) and American Association of University Women Fellowship (2003) and recently joined the Materials Science department of California Institute of Technology (Caltech). She is also a concert pianist, with most recent performance of Brahms Concerto No. 2 with the Redwood Symphony.