NSF Nanoscale Science and Engineering Center for High-rate Nanomanufacturing and the College of Engineering Seminar

TUESDAY, December 1, 2009 – Dodge Hall 450

SEMINAR SPEAKER

Prof. Teng Li

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SEMINAR TITLE

"Tailoring graphene morphology via surface/interface regulation"

PROGRAM

2:00 - 2:45 p.m. Lecture
2:45 - 3:00 p.m. Q&A and Discussion

ABSTRACT

Graphene, a monolayer of graphite, has rapidly emerged as a rising star of materials science and condensed-matter physics, largely due to its exceptional properties. These extraordinary properties of graphene have sparked a surge of scientific and technological interest in graphene-based electronics, driven by the desire to overcome the fast-approaching fundamental limits of silicon in 15~20 years. The promising future of graphene-based applications aside, there are still significant challenges to their realization, largely due to the difficulty of precisely controlling the graphene properties. Graphene is intrinsically non-flat and corrugates randomly. These random corrugations lead to unpredictable graphene properties, which are fatal for nanoelectronic devices.

Recent experiments suggest that, when graphene is subject to external regulation (e.g., a substrate surface), its corrugations are rather extrinsic, prevailing its intrinsic random corrugations. In this talk, we first lay out a general research framework that captures the energetics of the interplay between graphene and the external regulation, from which the equilibrium graphene morphology can be quantitatively determined. We then apply such a framework to investigate the graphene morphology regulated by engineered substrate surfaces with various patterns, such as 1-D grooves, 2-D herringbone and checkerboard. We next extend to study the graphene morphology regulated by nanowires patterned on a substrate surface. Interestingly emerging from the results is a morphological instability of graphene under certain conditions, in which graphene morphology snaps between two distinct states. Since the graphene morphology is closely tied to its electronic properties, such a morphological instability can be potentially used to enable functional components in graphene-based devices, such as nano-switches. Our research framework and case studies shed light on abundant but largely unexplored pathways to fine tune graphene properties through surface/interface morphologic regulation.

BIOGRAPHIC PROFILE

Prof. Teng Li received his Ph.D. in Engineering Science from Harvard University in 2006, and then joined the faculty of Department of Mechanical Engineering, University of Maryland in the same year. His research interests include mechanics of the micro/nano structures and materials in flexible electronics, deformation instability of thin films and multilayers, and mechanics of biomembrane and cytoskeleton in the cells. Among his awards includes the Ralph E. Powe Jr. Faculty Award (ORAU) in 2007, the Best Poster Award on Gordon Research Conference (GRC) on Thin Film & Small Scale Mechanical Behavior (2004, 2006) and the Outstanding Poster Award on Materials Research Society (MRS) (2004). He is the co-founder and architect of www.iMechanica.org, a web of mechanics and mechanicians, with ~17,000 registered users from all over the world as of Nov. 2009. Prof. Li is currently the Chair of the Technical Committee of Integrated Structures in ASME AMD Division.

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