AEROSPACE & MECHANICAL ENGINEERING

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INFORMAL COFFEE PERIOD BEFORE THE SEMINAR IN ROOM 365, ENGR. BLDG.

UNIVERSITY OF NOTRE DAME, NOTRE DAME, INDIANA 46556

SPEAKER: Dr. Nikhil Medhekar
Division of Engineering
Brown University
Providence, Rhode Island

TOPIC: **GROWTH, COMPOSITION, AND ELECTRONIC PROPERTIES OF NANOSCALE MATERIALS: SELF-ASSEMBLED ALLOY QUANTUM SYSTEMS AND GRAPHENE**

DATE: Tuesday, February 2, 2010

TIME: 3:30 p.m.

PLACE: 138 DeBartolo Hall

ABSTRACT

Self-assembled nanoscale quantum alloy systems, such as quantum dots, wires, and fortresses, are drawing significant attention for their potential applications in the next generation optical, electronic and photovoltaic devices. Current scientific and technological interest in these nanoscale systems is driven by the novel quantum mechanical phenomena associated with their nanoscale feature lengths. The electronic properties of these quantum systems are strongly influenced by their shape, elastic deformation, and, more importantly, by their composition. However, it is challenging to obtain the quantitative description of composition profiles due to the coupling between composition variations, shape, and long-range elastic interactions.

In this talk, I will present an efficient multiscale approach that combines finite element analysis with an optimization scheme to determine equilibrium composition profiles in strained quantum dots. Composition profiles are found to strongly depend on the shape of the quantum dots. For instance, strain relaxation in dots with steeper sidewalls allows for the segregation of the larger alloy component in the regions near the apex. Further, based on first-principles calculations, we find that the nonuniform composition strongly alters the quantization behavior. Our studies suggest that the novel quantum confinement phenomena that are otherwise only associated with length scale of a few nanometers can be achieved in much larger structures.

In the latter part of the talk, I will present a brief overview of my current research in grapheme and related materials. I will focus on how the atomic-level structure influences large-scale electronic and mechanical properties of these materials.

NOTE: *If you are interested in meeting individually with Dr. Medhekar, please contact Evelyn at 631-5431*