



Friday-February 10, 2017

12:00-1:00 PM

BECTON SEMINAR ROOM

Light lunch will be served at 11:45 a.m.

Xiaodong Zhu

Chemical & Environmental Engineering, Yale University
P/I Prof. Eric Altman

“Inducing Polarity in a Non-Polar Material”

The growth of non-polar Cr_2O_3 on oppositely poled ZnO surfaces was characterized to determine how the polar substrate influences the properties of the non-polar film. The growth is 2D; however, the films appear initially disordered on both substrates. With increasing film thickness, the films ordered with a well-defined epitaxial relationship. The HRTEM results for thicker films confirm a clear interface and well-defined lattice structure near the interface and throughout the film, indicating that above a critical thickness the entire film reorganizes into an ordered structure. The polar interfaces show a small but noticeable band offset that decayed with increasing film thickness. Statistical analysis of UPS valence band spectra revealed an enhanced density of states near the Fermi level for Cr_2O_3 on the positive surface consistent with stabilization of the positive interface by charge transfer; in contrast, no significant valence band differences were observed between bulk Cr_2O_3 and thin Cr_2O_3 thin layers on the negative surface. To determine if the interfacial properties are sensitive to how the interface is formed, the polarity of ZnO films grown on ZnO (0001) and ZnO (000 $\bar{1}$) with variable thickness Cr_2O_3 intermediate layers (ZnO/ Cr_2O_3 /ZnO) has also been studied. It was observed that the polarity of ZnO films grown on ZnO (0001) switched from positive to negative as the Cr_2O_3 intermediate layer thickened, while the polarity of ZnO films grown on ZnO (000 $\bar{1}$) remained negative regardless of the Cr_2O_3 intermediate layer thickness. These findings highlight the possibility to manipulate non-polar thin film surface properties with a polar substrate.

Luye Mu

Department of Electrical Engineering, Yale University
P/I Mark Reed

“Applications of pH-Sensitive nanoFETs in Biological Sensing”

Silicon nanowire field effect transistors (nanoFETs) are low noise, low power, and ultrasensitive biosensors that are highly amenable to integration. However, using nanoFETs to achieve direct macromolecular detection in physiological buffers remains difficult due to Debye screening, nonspecific binding, and stringent functionalization requirements. We circumvent these difficulties using an indirect method of detecting biomolecular interactions, by translating a specific binding response into a pH change that can be detected by our nanoFETs. Using this approach, we demonstrate sensitive detection of enzyme-substrate interactions, DNA, and proteins. Our method paves the way for future development of universal, highly sensitive, miniaturized, and integrated nanosensors that can be applied to a wide variety of analytes.

Host: Professor Eric Altman