



**Friday- January 31, 2014**

**12:00 to 1:00 p.m.**

**Becton Seminar Room**

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

**Monika Weber**

Department of Electrical Engineering, Yale University

**“Fluid-Screen: a rapid pathogen screener for bacterial infections”**

Every year water-borne bacteria cause millions of infections in humans and animals. Current bacteria detection methods are slow or expensive. The standard plate count, takes from 24 to 48 hours, due to the time needed for bacteria to grow detectable colonies. This time is too long for most applications. Faster methods, including PCR or labeled detection and fluorescent imaging, are too expensive to be widely applied. Here we present a proof of concept of miniaturized and fast bacteria detection device. Using dielectrophoresis, the device automatically separates any present bacteria from a water sample. For detection the devices uses nanoribbon/nanowire field effect transistors, which are demonstrated label-free nanosensors, capable of detecting low concentrations of biomolecules, i.e., disease markers to provide point-of-care diagnostics. In order to achieve selectivity and specificity of the detection and eliminate false-positive responses, the sensors are functionalized with bacteria specific antibodies.

**Matthew Herdiech**

Department of Chemical Engineering, Yale University

**“Metal Oxide Films on Ferroelectric Substrates for Switchable Catalysis”**

Polar surfaces result whenever crystals of compound materials are oriented such that a dipole moment can be associated with each bulk repeat unit perpendicular to the surface. For crystals of these materials, very large electrostatic potentials build up with increasing thickness of the material. Without compensating charges at the surfaces, the electric fields are divergent, and the surfaces are unstable. Because opposite sides of the crystal are oppositely charged, the charge compensation mechanism, which may include electronic and chemical reconstructions, will be different for each surface. Ferroelectric materials are materials where each unit cell possesses a net dipole, *and* the direction of the dipole can be switched by applying an electric field. Considering the different charge compensation mechanisms on oppositely poled surfaces, one can envision the intriguing possibility of a material with “switchable” surface properties. A step further is the idea of using ferroelectric films as substrates for tunable catalysts by depositing catalytically active metals or metal oxides onto them. This talk focuses on recent work with two model film/ferroelectric substrate systems currently being investigated in our lab:  $\text{Cr}_2\text{O}_3$  on  $\text{LiNbO}_3$  and  $\text{RuO}_2$  on  $\text{Pb}(\text{Ti},\text{Zr})\text{O}_3$ . For  $\text{RuO}_2$  on  $\text{Pb}(\text{Ti},\text{Zr})\text{O}_3$ , theoretical results and results from temperature programmed desorption measurements for the activity of this system toward  $\text{NO}$  are presented and compared to results for  $\text{RuO}_2$  layers on non-ferroelectric substrates. Using the  $\text{RuO}_2/\text{Pb}(\text{Ti},\text{Zr})\text{O}_3$  system as an example, it is shown that by adding an extra degree of freedom (i.e. the change in polarization direction of the substrate) to the catalyst system, it may be possible to achieve novel behavior, such as the direct decomposition of  $\text{NO}_x$ .

**HOST: Paul Fleury**