NANOHOUR

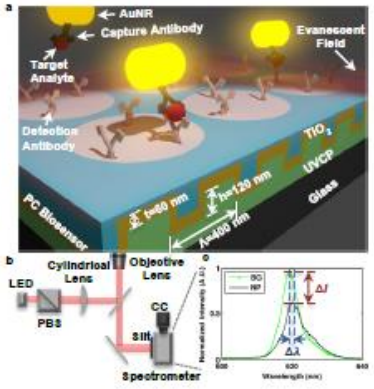
Wednesday, April 23, 2014 3:00 pm
Beckman Institute –Room 4269

Protein-protein Binding Detection Using Nanoparticle Photonic Crystal Enhanced Microscopy (NP-PCEM)

Yue Zhuo, Bioengineering

Graduate student with Professor Brian Cunningham

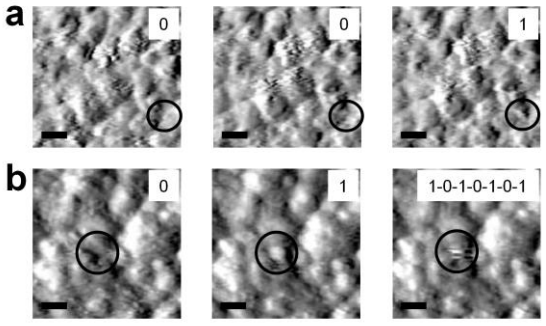
We demonstrate a novel microscopy-based biosensing approach that utilizes a photonic crystal (PC) surface to detect protein-protein binding with the functionalized nanoparticles as tags. This imaging approach utilizes the measurement of localized shifts in the resonant wavelength and resonant reflection magnitude from the PC biosensor in the presence of individual nanoparticles. Moreover, it substantially increases the sensitivity of the imaging approach through tunable localized surface plasmon resonant frequency of the nanoparticle matching with the resonance of the PC biosensor. Experimental demonstrations of photonic crystal enhanced microscopy (PCEM) imaging with single nanoparticle resolution are supported by Finite-Difference Time-Domain (FDTD) computer simulations. The ability to detect the surface adsorption of individual nanoparticles as tags offers a route to single molecule biosensing with photonic crystal biosensor in the future.



Determining the energy landscape of a glass surface by directly imaging its dynamics

Duc Nguyen, Chemistry

Graduate student with Professor Martin Gruebele



Direct visualization of the dynamics of glasses on the sub-nanometer scale provides rich information unavailable from bulk or conventional single molecule techniques. A million-fold speedup of our temporal dynamic range allows us to study the surface of hafnium diboride, a conductive ultrahigh temperature ceramic material that can be grown in amorphous films. Our scanning tunneling movies reveal two-state hopping of ~5 atom diameter cooperatively rearranging regions or 'clusters' from sub-milliseconds to hours. By directly measuring single cluster displacements, we can reconstruct the local free energy landscape for cluster dynamics, complete with activation barrier height, a numerically defined reaction coordinate, and fluctuating shape of the free energy landscape basins. Such data allow new tests of thermodynamic and kinetic theories of glassy dynamics.

Coffee and cookies will be served

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