

The Effect of Surface Roughness on the Deflection of Gold Coated Silicon Micro-Cantilevers Due To Molecular Adsorption

Victor Hayden

Department of Physics and Physical Oceanography
Memorial University

DATE: Tuesday, May 1, 2012

TIME: 3:30 pm

PLACE: C2045

ABSTRACT: In this work numerical simulations were performed in order to study the effects of surface roughness on the deflection of gold coated silicon cantilevers due to molecular adsorption. The cantilever was modeled using a ball and spring system where the spring constants for the Si-Si, Si-Au, and Au-Au bonds were obtained from first-principles calculations. The molecular adsorption process was simulated by elongating the natural bond length at available bonding sites. Increasing the bond length created a surface stress on the cantilever causing it to deflect. In all cases the structure refinement was performed by minimizing the energy of the system using a simulated annealing algorithm and a high quality random number generator.

The system studied consisted of a 1 micrometer by 1 micrometer portion of a cantilever of various surface roughnesses with variable boundary conditions. The results have indicated that cantilevers with a rougher gold surface deflect more than those with a smoother surface. This increase in deflection is attributed to an increase in the number of stress raisers in the gold film localized around the surface features. The onset of stress raisers increases the differential stress between the top and bottom surfaces and results in an increase in the deflection of the cantilever.

ALL ARE WELCOME!!!