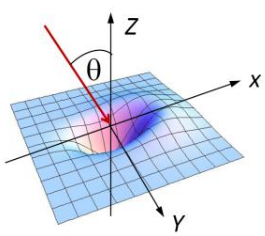
NANOHOUR

Wednesday, January 26, 2011 3:00 pm
Beckman Institute - Room 3269

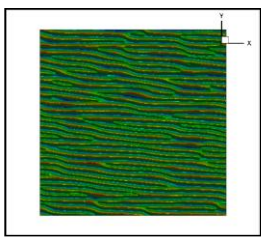
Atomistic studies of surface morphologies in ion bombarded surfaces

M. Zubaer Hossain, Mechanical Science and Engineering
Graduate Student with Professor Harley Johnson

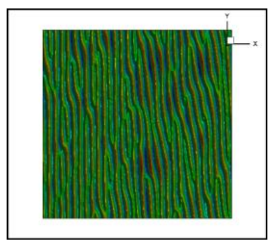
The rearrangement of atoms during ion bombardment of solid surfaces is known to lead to the formation of regular nanometer-scale surface patterns. The nature of these patterns depends on a combination of ion energy, the types of target material and ion, and the angle of incidence. A variety of surface morphologies, such as ripples oriented parallel or perpendicular to the ion direction or dots, are observed experimentally. However, the fundamental mechanisms governing the orientation of ripples; and how the ion energy, ion type, and angle of incidence affect their formation remain unclear. Invoking a multiscale approach, we study the femtosecond atomistic mechanisms during ion bombardment of single impacts and use a diffusion-based continuum description to examine their role on the evolution of long timescale surface morphologies. In contrast to existing theories, which are mostly based on the Bradley-Harper sputter-erosion instability, a simple moment-based hypothesis is developed for characterizing the transitions between different surface morphologies. The results are compiled in a phase diagram that shows the transition boundaries between different classes of surface morphologies as a function of the different crater moments.



A typical crater-shape formed by single ion impacts



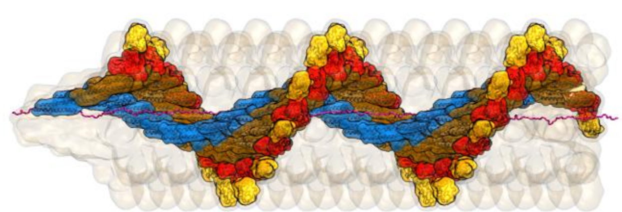
Ripples formed perpendicular to the ion beam direction



Ripples formed parallel to the ion beam direction

Flagellin Polymer Translocation through the ~3nm Flagellar Channel

David Tanner, Biophysics
Graduate Student with Professor Klaus Schulten



The bacterial flagellum is a self-assembling filament, which bacteria use for swimming. It is built from tens of thousands of flagellin monomers in a self-assembly process involving translocation of the monomers through the flagellar interior, a 3nm diameter channel, from the base to the growing tip. Each monomer is pumped into the filament at the base, translocates unfolded along the channel and then binds to the tip of the filament, thereby extending the growing flagellum. The flagellin translocation process, due to the flagellum maximum length of 10 μm, is an extreme example of protein transport through channels. A theoretical model for flagellin transport through the long confining channel, tested through molecular dynamics simulations, describes the flagellin transport process. Together, the theoretical model and molecular dynamics simulations explain why the growth rate of the flagellar filament decays exponentially with filament length.

Coffee and cookies will be served

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