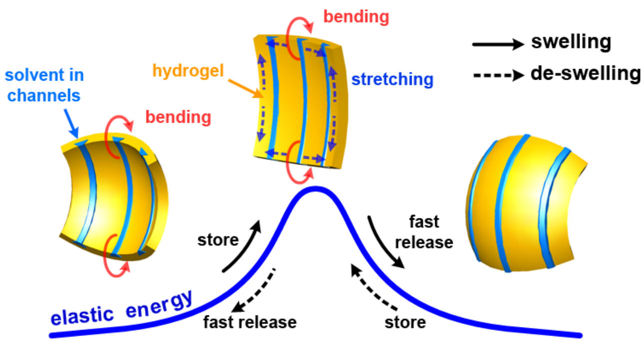
NANOHOUR

Wednesday, September 29, 2010 3:00 pm
Beckman Institute - Room 3269

Projection micro-stereolithography(PμSL) and bio-inspired soft active devices

Howon Lee, Mechanical Science and Engineering

Graduate Student with Professor Nicholas Fang



Adaptive materials that can sense and react to external signals have been attracting growing attention in various fields of science and engineering because of their potential for autonomous and multifunctional devices and systems. Hydrogels, which swell and contract in response to a wide range of environmental changes, have been intensively studied as one of the most promising functional materials. However, the operation speed of hydrogel-based devices is inherently limited by the slow diffusion of solvent into polymer network. On the other hand, nature offers a novel solution to breach this barrier as demonstrated in the insect-trapping action of Venus flytrap. This astonishingly fast motion is attained by involving snap-buckling instability. Inspired by this exquisite mechanism, here we present rapid actuation of a micro hydrogel device by exploiting swelling-induced snap-buckling. Micro-structured 3D hydrogel device was fabricated using a novel 3D fabrication system, projection micro stereo-lithography (PμSL). Utilizing fast actuation speed, the device can even jump upon wetting. We demonstrate that elastic energy is effectively stored and quickly released from the device by incorporating elastic instability. In our experiment, the micro device could generate a snapping motion within 12 milliseconds, releasing power at a rate of 34.2 mW/g. This engineered microgel will open up new gateways for intelligent systems in diverse fields, such as microfluidics, soft robotics, artificial muscle, and biomedical engineering.

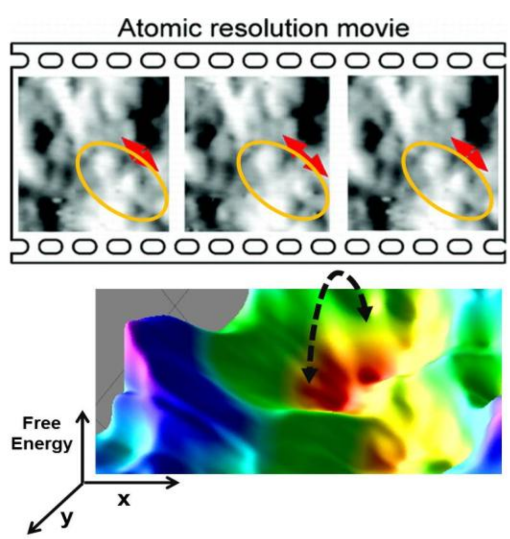
Visualizing atomic motions on amorphous surfaces using scanning tunneling microscopy

Sumit Ashtekar, Chemistry

Graduate Student with Professor Martin Gruebele

Glass transition is one of the most important unsolved problems in solid state physics. Even after half century of research, various glass theories don't agree on even the basic aspects of glass transition. Many theories assume spatial and dynamic heterogeneity to exist in glasses but no direct evidence was available.

We capture atomic resolution movies of various metallic glass surfaces using scanning tunneling microscopy. The movies give direct evidence of spatial and dynamic heterogeneity as we are able to follow the motion of individual clusters of atoms. We found that the surface dynamics occur in a collective fashion where clusters (2-8 atoms wide) exclusively hop in a two-state fashion. Recent experiments have shown similar dynamics to exist in ion bombarded amorphous silicon surfaces.



Coffee and cookies will be served

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