

Nanomechanical Devices:

From Acoustic Holographic Imaging to MOSFET-Embedded Microcantilevers for Bio-Chem Sensing

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Emergence of nanoscience and nanotechnology has ushered a renewed appreciation for interdisciplinary contributions to advancing science and technology. A great number of such advances revolve around synergistic combination of disparate disciplines and fields, and promise to open new vistas for wide variety of technologies and applications.

Mechanics at the nanoscale is no exception, and the focus of the presentation will be to demonstrate the relevance of nanomechanics in diverse phenomena and technological applications. Two major Northwestern initiatives in interdisciplinary nanomechanics will be presented,

- a) Scanning near-field ultrasound holography (SNFUH)^{1,2}, which provides for an unprecedented nanoscale imaging approach, which is non-destructive and sensitive to buried and embedded features due to elastic and viscoelastic response to acoustic waves, and
- b) MOSFET-embedded microcantilevers³ for nanomechanical signal transduction in bio-chem sensing, where specific molecular binding-induced nanomechanical bending of microcantilevers is analyzed electronically by the embedded MOSFET.

The apparent disparate approaches above share the common denominator of scanning probe microscopy (SPM) platform - where SNFUH imaging is facilitated by SPM tip which acts as an acoustic antenna, while MOSFET-embedded microcantilevers derive their bio-chem sensing from drain current sensitivity to stress in MOSFET channels. The presentation will demonstrate the synergy among the two approaches and their relevance to nanoscale imaging and bio-chem sensing.

- 1) G. Shekhawat and Vinayak P. Dravid, **Science**, 7 October 2005: Vol. 310. no. 5745, pp. 89 – 92
- 2) Alain Diebold, **Science**, 7 October Vol. 310. no. 5745, pp. 61 - 62
- 3) G. Shekhawat, S. Tark and Vinayak P. Dravid, **Science**, Published Online February 2, 2006, to appear in paper print, March 2006.