



**Mechanical
Engineering**

SEMINAR

Reliability of Metallic MEMS Structures

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This talk presents the results of a multi-scale experimental and theoretical/computational study of the key failure mechanisms associated with the reliability of metallic micro-electro-mechanical systems (MEMS). The talk is divided into two parts. In the first half, the mechanisms and mechanics of adhesion are explored between the nano- and micron-scales. A combination of atomic force microscopy (AFM) experiments and studies of cantilevered MEMS structures is used, respectively, to measure the adhesion energies of discrete asperity contacts and MEMS structures. These are modeled using adhesion theories and fracture mechanics/crack-tip shielding concepts. The implications of the results are then discussed for multi-scale design against adhesion and stiction. In the second half of the talk, the mechanisms of fatigue are presented for nickel MEMS thin films that are being explored as robust alternatives to silicon. Novel focused ion beam techniques are used to elucidate the mechanisms of crack nucleation and nano-/sub-micron-scale fatigue crack growth. The insights from the experiments are then used to guide the development of dislocations-based fracture mechanics models for the prediction of fatigue limits and fatigue thresholds.



Wole Soboyejo received his PhD in materials science from Cambridge University in 1988. He then worked as a Research Scientist with McDonnell Douglas from 1988 to 1992. From 1992 to 1999, he was on the faculty in the Department of Materials Science and Engineering at The Ohio State University. He spent a year as a Visiting Martin Luther King Professor in the Department of Mechanical Engineering and the Department of Materials Science and Engineering at MIT from 1997 to 1998. In 1999 he joined the Mechanical and Aerospace Engineering Department at Princeton University as a full Professor. Professor Soboyejo is the Chair of the African Scientific Committee and the Director of the US/Africa Materials Institute. He is the recipient of two National Young Investigator Awards (NSF and ONR) and ASM Bradley Stoughton Award for young teachers of materials science. He is also the author of a textbook on the mechanical properties of engineered materials. Prof. Soboyejo's current research focuses on biomaterials, MEMS/nanomaterials and alternative strategies for global development.

FRIDAY, October 5th, 2007

12:00pm Seminar in 227 Mudd

1:00 pm Lunch in ME Lobby