

DSN-I Seminar Series

*Professor Maarten P. de Boer*

Micro- and Nanomechanics

WHEN: October 17, 2014**WHERE: Scaife Hall 125****TIME: 3:30 p.m. - 5:00 p.m.****► Abstract**

Our research in the area in micro- and nanomechanics involves using microscale actuators to create in-situ platforms to measure mechanical properties at the micro- and nanoscales. In this talk, I will overview recent results, emphasizing breadth over depth. Because of the small specimen size, interactions with the environment and with adjacent surfaces are of critical concern. We have constructed an interferometric microprobe station that provides environmental control while testing devices. This enables, for example, the measurement of crack healing velocities, an important MEMS reliability concern. In another project, we are exploring the possibility of complementing transistors with nanomechanical switches. Materials, mechanical stress, electrical current and environment are all factors in keeping switch resistance low over billions to trillions of cycles. In a third project, we have developed a test platform to measure the stick-slip cycle emulating the classic macroscale puller-spring-mass test. This offers insights into rate-state friction, in which memory effects play a strong role. In a fourth, we find that materials become stronger as size reduces – this can be well modeled using Weibull statistics. But to do so, we must recognize that a parameter known as the threshold strength depends on stress gradients. Finally, for nuclear energy materials study, we are fabricating a new platform to study irradiation induced creep using thermodynamically stabilized nanocrystalline metals. Microscale actuators coupled with test structures provides a powerful vehicle for gaining high resolution information on micro- and nanoscale mechanical properties.

► Speaker Bio

Maarten de Boer received BSEE and MSEE degrees from Cornell University and the University of Colorado at Boulder in 1981 and 1982, respectively. He developed advanced integrated circuits at Hewlett-Packard in Fort Collins, CO until 1991. In 1996, he completed his PhD at the University of Minnesota, Minneapolis, in Materials Science, specializing in fracture mechanics. He then joined Sandia National Labs, Albuquerque, NM, and in 2007 he joined the Mechanical Engineering Department at Carnegie Mellon University in Pittsburgh, PA. He teaches courses in Thermodynamics, Materials Selection and Experimental Micro- and Nanomechanics. He has authored or co-authored 50 journal papers on subjects including thin film fracture mechanics and mechanical properties, adhesion, friction, actuators, sensors and metrology.