

UNIVERSITY OF RHODE ISLAND

Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Location: Lippitt Hall 204

Time: Monday, March 20, 2017, 1:00pm
(refreshments at 12:50 p.m.)

Soft Pad Scratches a Harder Surface? Inconceivable! A Continuum Mechanics-Based Mathematical Model Applied to a Common Microelectronics Process

by **Prof. DML Meyer**

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Abstract: Your cell phone, tablet, laptop and ipad all have them. They are the integrated circuits (ICs) fabricated using a typical microelectronics process called chemical-mechanical planarization (CMP). The process appears simple: a “soft” viscoelastic pad polishes an uneven “harder” wafer surface containing nanoscale features from patterned layers of deposited materials. Multiple layers of the patterned conducting and insulating harder materials are added on top of previous layers until the IC is complete. In between each layer, CMP is employed. The CMP process can and does cause scratching of the wafer surface. These “killer” scratches are an order of magnitude, or more, larger than the nanoscale features themselves, reducing the manufacturing yield of IC components. A continuum mechanics description of the mechanisms of scratching of the wafer surfaces by the viscoelastic pad will be presented, along with a mathematical model and validating experimental results. The constructed thermomechanical model provides a means to track the input energy dissipation influencing scratch production.

Continuum mechanics examines the overall behavior of materials exposed to external influences. It is primarily focused on the quantities of stress, strain and displacements that result in energy dissipation and material damage, such as plastic deformation. Continuum mechanics approaches allow for the prediction of material behavior which can be used to tailor composition and fabrication processes.

Bio-Sketch: Donna Meyer completed her doctoral degree in 1999 in Mechanical Engineering from Rensselaer Polytechnic Institute, Troy, NY, and previously, the B.S. degree in 1993 in Mechanical Engineering from the University of Hartford, West Hartford, CT. She has 15 years of industry experience, three years with Windsor Manufacturing, Windsor, CT and twelve years as a Nuclear Engineer with ABB Combustion Engineering, Windsor, Ct. Prof. Meyer’s current research makes use of experiments and analytical models for all types of materials in the areas of continuum mechanics to solve real-world engineering problems. Tribological problems related to contact mechanics and dissipative processes are also of special interest. She directs the Thermomechanics Laboratory at URI: <http://egr.uri.edu/thermomechanicslab/>.