Announcing the Final Examination of Imen Rezadad for the Degree of Doctor of Philosophy in Physics

Date: Monday, July 06, 2015
Time: 10:00 a.m.
Room: PSB 161 (Physical Sciences Building, Room 161)
Dissertation title: Electromechanical lifting actuation of a MEMS cantilever and Nano-scale Imaging of Diffusion in Semiconductor Device Dielectrics

Abstract:
This dissertation presents experimental and theoretical studies of physical phenomena in micro- and nano-electronic devices. Firstly, a novel and unproven means of electromechanical actuation in a micro-electro-mechanical system (MEMS) cantilever was investigated. In nearly all MEMS devices, electric forces cause suspended components to move toward the substrate. I demonstrated a design with the unusual and potentially very useful property of having a suspended MEMS cantilever lift away from the substrate. The effect was observed by optical micro-videography, by electrical sensing, and it was quantified by optical interferometry. The results agree with predictions of analytic and numerical calculations. One potential application is infrared sensing in which absorbed radiation changes the temperature of the cantilever, changing the duty cycle of an electrically-driven, repetitively closing micro-relay. Secondly, thin high-k dielectric layers in 22 nm gates of two modern semiconductor devices were studied. The purpose was to characterize composition of these layers and resolve a question regarding whether transmission electron microscope (TEM) with energy dispersive spectroscopy (EDS) could sufficiently resolve the atomic diffusion at such small length scales. Results of analytic and Monte-Carlo numerical calculations were compared to experiment to validate ongoing semiconductor device failure analysis, quality control, and intellectual property protection.

Outline of Studies:
Major: Physics

Educational Career:
M.S. in Physics, University of Central Florida, 2013
M.S. in Solid State Physics, Iran University of Science and Technology, 2010
B.S. in Physics, Shahid Beheshti University, 2008

Committee in Charge:
Dr. Robert Peale (Chair)
Dr. Enrique del Barco
Dr. Laurene Tetard
Dr. Brenda Prenitzer (External Committee Member)

Approved for distribution by Dr. Robert Peale, Committee Chair, on June 22, 2015.

The public is welcome to attend.