Graduate Seminar (EEL 6936)
Department of Electrical Engineering
http://ee.eng.usf.edu/Grad_Seminar

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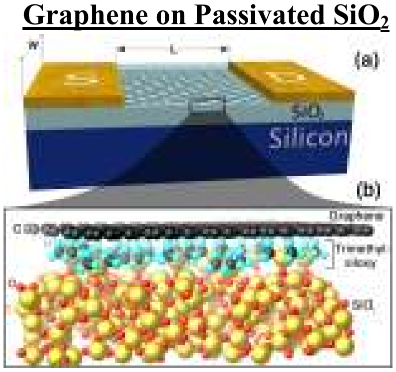
Friday, October 24, 2014, 3:35-4:25 p.m., ENB 109

Radiation Effects and Radiation-Induced Modification of Carbon Nanomaterials and Devices

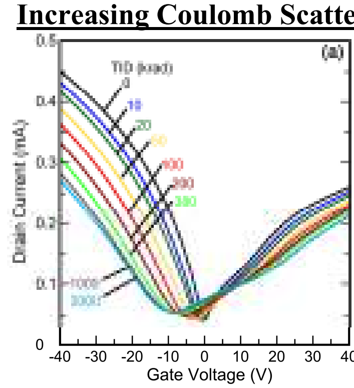
Abstract

Advances in chirality separation techniques of single walled carbon nanotubes (SWCNTs) and the large-area CVD growth of graphene provide a feasible transition path for these carbon-based nanomaterials (CN) from novel laboratory curiosities to a viable alternative class of materials for use in information processing and sensing devices. The remarkable electrical, optical, and structural properties of CN are well documented and rooted in their single atomic-layer *thinness* and quantum confined electronic bandstructure. However, the unique structure of CN leaves them highly sensitive to intrinsic disorder (lattice defects [1]) and extrinsic disorder (Coulomb scatterers [2]) from radiation exposure. Studying the radiation response of CN is an effective tool for understanding the fundamental properties of CN, and is necessary to ensure the survivability of future carbon nanoelectronic devices in the harsh radiation environments of space. Moreover, controlled radiation exposure provides a rational means for modifying the structural and electronic properties through vacancy generation or direct substitutional doping. In this seminar, I will introduce the techniques used to simulate the space environment and provide a detailed review of our findings regarding intrinsic and extrinsic radiation response of SWCNTs and graphene. I will conclude by providing recent results on a hyperthermal ion implantation (HyTII) technique we have developed to substitutionally dope graphene and modify its electronic properties.

Graphene on Passivated SiO_2



Increasing Coulomb Scattering



References:
[1] J. E. Rossi, C. D. Cress, et al., *J. Appl. Phys.*, Vol. 112, No. 3, p. 034314, 2012.
[2] C. D. Cress, et al., *IEEE Trans. Nucl. Sci.*, Vol. 59, No. 6, pp. 3045–3053, 2012.

Biography

Dr. Cory D. Cress received his Ph.D. in Microsystems Engineering from the Rochester Institute of Technology (RIT) in 2008, and is currently a Materials Research Engineer at the Naval Research Laboratory (NRL). His doctoral research consisted of investigating the effects of ionizing radiation on nanomaterials and III-V devices, and the development of radioisotope batteries. He has co-authored 45 peer-reviewed journal publications in the field of radiation effects and nanotechnology. Notable recognitions include a NRL Karles Fellowship (2009), a National Research Council (NRC) Postdoctoral Research Associateship (2008), a NASA Graduate Student Research Fellowship (2006), and multiple best paper/poster awards (2014, 2013, 2009, 2008, 2007). Dr. Cress currently has one issued patent and 3 patents pending.