CMP Seminar
Michigan State University

Deji Akinwande
TI/Jack Kilby Associate Professor
Electrical and Computer Engineering
University of Texas - Austin

Silicene and Phosphorene: New Device Physics of Buckled Atomic Sheets

Buckled atomic sheets such as phosphorene and silicene promise interesting anisotropic phenomena, strongly coupled multi-physics, and topologically protected states such as the quantum spin Hall effect. Here, we report key results of critical importance for device studies and understanding including phosphorene devices featuring: i) record mobility (μ) ~1560cm2/V.s about an order of magnitude higher than other 2D semiconductors, ii) ambipolar current saturation that is more desirable for optoelectronics than graphene because of its sizeable direct bandgap, and iii) the first coupled opto-electro-mechanics studies. Experimental results on silicene represents the first device studies that is enabled by advanced materials growth and integration, and confirm the graphene-like Dirac transport. In addition, the common air-stability issue of great concern is investigated with microwave impedance microscopy (MIM) revealing the roller-coaster progression of transport and degradation that is generally invisible to other characterization techniques. Progress towards quantum spin Hall studies in 2D materials will be reviewed. Collectively, the record mobility of phosphorene makes it the most compelling 2D semiconductor, while silicene's allotropic affinity with bulk Si and its new physics of various topological states suggests a more direct path for semiconductor technology integration.

Dr. Deji Akinwande received the PhD degree in Electrical Engineering from Stanford University in 2009, where he conducted research on the synthesis, device physics, and circuit applications of carbon nanotubes and graphene. His Master's research in Applied Physics at Case Western Reserve University pioneered the design and development of near-field microwave probe tips for nondestructive imaging and studies of materials.

He is an Associate Professor with the University of Texas at Austin. Prof. Akinwande has been honored with the inaugural IEEE Nano Geim and Novoselov Graphene Prize, the IEEE "Early Career Award" in Nanotechnology, the NSF CAREER award, the Army and DTRA Young Investigator awards, the 3M Nontenured Faculty Award, and was a past recipient of fellowships from the Ford Foundation, Alfred P. Sloan Foundation, and Stanford DARE Initiative. He recently co-authored a textbook on carbon nanotubes and graphene device physics by Cambridge University Press, 2011. His recent results on silicene have been featured online by nature news, Time magazine among other media outlets. His work on flexible 2D electronics was selected as among the "best of 2012" by the nanotechweb news portal and has been featured on MIT's technology review and other technical media outlets.

Monday, Oct. 5, 2015
4:10 PM
BPS 1400
Prof. David Tomanek - Host