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"Oxygen Catalytic Growths and Multi-functionalities of CNTs and Graphene"

Wednesday, April 9
320 Shilllman Hall
11:45 a.m. – 1:00 p.m.

Refreshments will be served

ABSTRACT Graphene and carbon nanotubes (CNTs) have been at the forefront of nano-materials research. Advances in growth techniques have accelerated materials developments for various applications as CNTs super-growth in water vapor, large single crystalline graphene growth on oxidized metal surface, long length CNTs growth up to 0.5m, and metal-free graphene and CNTs growth on SiC have been achieved. Low concentration of oxygen or oxygen contained molecules is present in all of these growth processes. My group has focused on the fundamental understandings of oxygen atomic catalysis at the nano-confinements in low dimensional carbon nano-structural growths since 2005. Diffusion controlled metallic catalytic CNTs growth by solid carbon source provides a simple path to investigate the role of oxygen and metal catalysts. Oxygen interactions with graphitic networks play a key role in the initial growth, and metal particle is responsible for carbon transports during the growths. Oxygen partial pressure at $10e^{-8}$ torr promotes CNTs growth, and at lower pressure for graphene growth. Metal free graphene/SiC and aligned CNTs/SiC growth is an ideal model to isolate oxygen catalytic effects. A thermal stable C-O compound is found at the range of growth temperature from 1300-1700°C. Oxidative structural transition in graphene growth on SiC is observed. Graphene is grown on oxidized SiC similar to graphene growth on oxidized metal surface. A strong oxygen bonded structure on graphitic hexagonal networks is associated with the catalytic effects. Graphene exhibits multi-functionalities. Oxygen catalytic effects and the post growth process improve electronic transport properties of graphene/SiC for high speed electronics. Through collaborations, 3D graphene Pillared structure is grown by oxygen catalytic effects for thermal managements and energy devices. Materials developments for non-linear optics and two dimensional dielectric confinements in high power devices also will be discussed briefly.

BIOGRAPHY Weijie Lu received his PhD in materials engineering and MS degree in chemical engineering from Brown University, a MS degree in physics from the University of Memphis, a MS degree in catalysis from China University of Science and Technology, and a BS degree in chemical engineering from the Zhejiang Institute of Technology, China. He was an associate professor of chemistry and physics at Fisk University in Nashville, Tenn. His research program is in the areas of fundamental issues in growth and characterization of low-dimensional carbon nanomaterials, surface and interface science, nano-fabrication, and science education. He has received two teaching awards and served as Program Director at Fisk University for the National Center for Learning and Teaching of Nano-sciences and Nano-engineering (NCLT) from 2004 to 2010. He has 70 publications and 100 presentations, including patents, book chapters, and invited reviews.