Title: Graphene Nanoelectronics

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Brief Biography

Dr. C.Y (Chun-Yung) Sung He is currently in IBM T.J. Watson Research Center at Yorktown Heights, NY as DARPA CERA Graphene Senior Program manager and SRC Nanoelectronics Research Initiative (NRI) IBM Sr. program director focusing on graphene and post CMOS device research. He was IBM exploratory device integration department manager. His research interests include carbon nanoelectrononics and next generation devices. C.Y Sung received M.S., Ph.D degrees in electrical engineering from the University of Michigan, Ann Arbor, MI. He joined Applied Materials and VLSI R&D Department in Bell Laboratory, Lucent Technologies before joined IBM in 2001.

Short Abstract

Graphene FETs (GFET) yield the highest cut-off frequency (fT) values reported: >300 GHz on epitaxially grown SiC wafer and >150 GHz on CVD-grown-transferred onto Si wafer which are well above Si MOSFET fT-Lg trend in ITRS. IBM implemented in-situ monolayer control using LEEM, which is capable of monolayer thickness precision and provides real-time electron reflection images, allowing graphene formation via Si desorption from the SiC surface to be studied, optimized and controlled. Graphene uniformly across Si-face SiC wafers with only monolayer variation, exhibiting high mobility. CVD is a promising way to produce large-scale graphene which hold great commercialization potential at low cost. IBM demonstrated large dimension, single layer high quality graphene sheets CVD grown on Cu foil and transferred to 8-“12” Si wafer. The talk will also describe the world first wafer scale graphene integrated circuit 10 GHz mixer fabricated by IBM. These are important advances in large scale graphene synthesis, device and circuit technologies. A novel reconfigurable graphene p-n junction based logic device is also introduced. Its switching is accomplished by using co-planar split gates that modulate the properties that are unique to graphene including angular dependent carrier reflection which can dynamically change the device operation, leading to reconfigurable multi-functional logic.

The talk is going to focus on large-scale graphene that are likely to be realized within the next 3-10 years. The challenges and practical hurdles which need to be overcome on the road from research to industry, and the opportunities and advantage over competing technologies will be discussed. Many future graphene nanoelectroics applications will also be introduced as well.

Outline

Large Scale Graphene Synthesis Technologies
Graphene Nanoelectronics Device and Circuit Development
Applications and Markets
Challenges and Opportunities