SUCCESS AND CHALLENGES IN THE SYNTHESIS OF EPITAXIAL GRAPHENE ON SiC FOR ELECTRONIC APPLICATIONS

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Abstract: In spite of many exciting properties of epitaxial graphene (EG), its use in the fabrication of improved high frequency and scalable Radio Frequency field-effects transistors (RF FETs) with terahertz cutoff frequencies is still elusive. At present, fabrication of device structures on EG grown on 4H- or 6H-SiC wafer sized scale are constrained by surface morphological inhomogeneities that may degrade electrical properties. In addition, EG growth on the vicinal Si-face results in step bunching of the underlying SiC with vertical step heights of 10 ? 15 nm and poses a significant challenge to device development. Although the quality of EG grown on SiC has improved, there are still impediments, such as low carrier mobility and large-area out-of-plane non-uniformity, which limit applications in a wide range of truly wafer-scale technologies. In this presentation, key elements of epitaxial graphene synthesis will be highlighted and discussed with regard to impacts on large-area uniformity, structure, and electrical properties. Typical characterization techniques will be examined as well. The dependence of specific components such as CVD growth-reactor design and substrate quality are examined in an effort to provide a pathway for future advancements in EG industrial production. Finally, key future directions for research in EG will be discussed.

Bio of Dr. Nyakiti: Luke Nyakiti, MS, PhD. Is currently Assistant Professor in the department of Marine Engineering and Technology at Texas A&M University ? Galveston Campus and affiliated faculty member in the Department of Material Science and Engineering at Texas A&M University ? College Station. He obtained his MSc. Physics degree from Wichita State University and later received his doctorate degree from Texas Tech University in Mechanical Engineering in 2008. He was awarded ASEE-NRL Postdoctoral Research Fellowship and was in residence at US Naval Research Laboratory - Washington D.C. where he took lead in synthesis-
structural characterization and functional property relationship of two dimensional materials systems and their integration into device nanostructures e.g. graphene Field Effect Transistors. He has authored or co-authored over 50 peer reviewed Journal publications in the areas of graphene, SiC, AlN, GaN, etc. He recently received an award by Japan Society of applied Physics (JSAP) 2014, for his research that resulted in the first-time synthesis of large area, high quality GaN on graphene. Dr. Nyakiti is active in several national and international material science and engineering societies, such as Material Research Society (MRS), American Vacuum Society (AVS), American Chemical Society (ACS), American Physical Society (APS) and American Association for the Advancement of Science (AAAS).

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