

World Congress and Expo on
Nanotechnology and Materials Science

April 13-15, 2015, Dubai, UAE

Recent Progress of heteroepitaxy on high-quality GaAs on Silicon

Shamsul Arafin, Chia-Pu Chu, Yazeed Alaskar and Kang L. Wang

University of California, USA

II-V compounds epitaxially grown on silicon (Si) have attracted immense research interests for many years due to its applications in integration of optoelectronic devices with Si-based mature microelectronic technology. However, such direct heteroepitaxy is mainly challenged by lattice mismatch, polaron nonpolar epitaxy, and thermal expansion mismatch. Such intrinsic material related problems can be overcome by two different techniques. One of the methods is the nanoscale growth of GaAs on patterned silicon substrates. Recently, using a record-thin buffer layer, high quality, defect-free and atomically-smooth GaAs thin films on silicon are successfully deposited by employing a patterned growth technique where GaAs films are grown by molecular beam epitaxy on silicon dioxide patterned silicon substrates. Very recently, high quality application-suited planar InGaAs/GaAs multilayer heterostructures on patterned silicon substrates utilizing ultra-thin buffer layer have also been demonstrated. As a second method, the quasi van der Waals epitaxial (QvdWE) growth of GaAs on Si using a two-dimensional layered material, graphene, as a lattice mismatch / thermal expansion coefficient mismatch relieving buffer layer is a novel route towards heteroepitaxial integration in the developing field of silicon photonics. In this study, we report the two-dimensional (2D) growth of GaAs thin films on graphene/Si system to create 3D/2D heterostructures. Here we show – for the first time - ultra-smooth morphology of quasi-epitaxial GaAs films on silicon using QvdWE, making it a remarkable step towards an eventual demonstration of the epitaxial growth of GaAs by this approach.

Biography :

Shamsul Arafin is a Postdoctoral Research Scholar in Device research laboratory at University of California at Los Angeles, USA. He received the B.Sc. degree in Electrical and Electronics Engineering from Bangladesh University of Engineering and Technology (BUET), Bangladesh in 2005 and the M.Sc. degree in Communication Technology from Universität Ulm, Germany, in 2008. He received his Ph.D. degree from Technische Universität München, Walter Schottky Institut Germany in 2011. In 2012, he joined the nanophotonics group of Electrical and Computer Engineering Department at McGill University as a post-doc fellow. Till now he has authored and coauthored more than 60 papers in leading technical journals and international conferences.