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Monolithic integration of III-V nanowires with silicon

In this talk, I will review recent achievements in monolithic integration of optical III-V nanowires and nanowire-based heterostructures of different types [axial, radial, “quantum dot in nanowire” and crystal phase wurtzite-zincblende (WZ-ZB) heterostructures] on silicon surfaces. The vapor-liquid-solid (VLS) as well as catalyst-free bottom-up approaches to grow conventional III-V and GaN nanowires on silicon can pave new ways for integration of III-V-based optoelectronics with the existing silicon electronic platform. Due to their small dimensions in contact with the substrate and/or within hetero-interfaces, nanowires allow for a radical decrease of the dislocation density and even the dislocation-free growth of dissimilar semiconductor materials and combinations. In particular, I will show how Ga-catalyzed VLS growth of GaAs nanowires by molecular-beam epitaxy produces size and spatially uniform arrays of photonic nanostructures. I will discuss the optical heterostructures within III-V nanowires and their interfacial abruptness compared to planar layers and then will show some impressive results on the nanowire-based microlasers. I will also demonstrate that the comprehensive growth modeling helps to understand and tune very delicate nanowire properties to the desired values that are often unique and inaccessible within standard planar technologies.

Biography

Vladimir G Dubrovskii has received his BS and MS degrees from Saint Petersburg University, and PhD and DSc degrees from Ioffe Institute and Saint Petersburg University in 1986, 1988, 1990 and 2002, respectively, in Condensed Matter Physics. His research interest has been in the areas of condensed matter physics and semiconductor nanostructures. He has authored more than 450 papers in leading technical journals and conferences and 2 monographs. His current research interests are mainly concentrated on nanowire modeling as well as on nucleation theory with applications in physics of semiconductor nanostructures. He is the Head of the Laboratory of Physics of Nanostructures at St. Petersburg Academic University, Head of the International Laboratory “Physics of Epitaxial Nanostructures” at ITMO University and Leading Research Scientist at Ioffe Institute. He is a Member of Steering Committees of International Symposium “Nanostructures: Physics and Technology”, Nanowire Growth Workshop and iNOW Workshop. He is the recipient of a number of academic and university awards and has been a high-level Visiting Scientist at Beijing University of Posts and Telecommunications.

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