Antimonide quantum materials for laser applications

Q. Zhuang[1], Z. M. Jin[1], P. Hodgson[1], H. Manus[1], A. M. Sanchez[2]

[1] *Physics Department, Lancaster University, UK*
[2] *Physics Department, Warwick University, Warwick, UK*

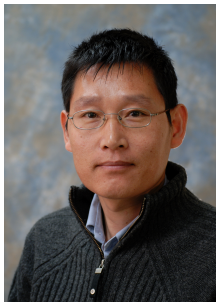
Abstract

Antiminide materials are featured with their large spin-orbit splitting energy, that could supress the Auger recombination consequently advance in the applications for lasers. However, its combination with arsenide materials always constructs a hole-confinement type-II band alignment, which reduces electron-hole wave-function overlap and makes them less attractive for use in lasers. Use of quantum ring (QR) and quantum dot (QD) geometries in antimonide/arsenide heterostructures, produces strong Coulomb binding of electrons to the positively charged QR/QD [3,4] which allows efficient radiative recombination resulting in photoluminescence emission up to 400 K. In addition, the QR/QD of GaSb/GaAs offers room temperature emission wavelengths in the commercially important 1260-1675 nm telecom bands, while InSb/InAs QD provides emission wavelengths in the important mid-infrared range (2.0-5.0 um). In this talk, I will review our recent research achievements in GaSb/GaAs QR lasers for telecom use and InAs/InAs QD mid-infrared lasers. Further more, I will discuss the quantum structures of GaSb disks embedded in GaAs nanowire and their potential applications in single photon emissions.

Keywords — *Antimonide, quantum dot, quantum ring, laser*

Professional Biography

Qian-Dong Zhuang gained his PhD from the Institute of Semiconductors, CAS, China in 1999. He is a Senior Lecturer in the Physics Department at Lancaster University, UK. He is the group leader of MBE Research Laboratory where he has been leading the research in MBE grown semiconductor nanostructures. His current research is focused on novel dissimilar alloys, quantum dots, nanowires, semiconductor/graphene hybrid material systems, ranging from MBE epitaxial growth to development of optoelectronics through fundamental physics studies. He has published 2 book chapters and more than 70 papers in peer-reviewed scientific journals including Nano Letters, Nature Communication, Nanoscale, Applied Physics Letters and Physical Review B. He is an Editorial Member of Nature Scientific Reports. http://www.physics.lancs.ac.uk/people/qiandong-zhuang



Email Id: q.zhuang@lancaster.ac.uk
Contact Number: 0044(0)1524594198