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Optical properties of type II QWs for interband cascade lasers

Grzegorz Sęk
Wrocław University of Technology, Poland

Abstract

Applications related to the sensing of hazardous and environmentally relevant gasses drive the growing demands for sensor components requiring cheap, compact, fast and tunable laser sources. However, in many cases, the respective devices able to emit in the ranges of the maximum absorption, which for many gasses fall into the mid infrared range, are not commercially available. The target range, which is usually about 3-5 µm (up to 8 µm even), can potentially be achieved by several approaches, having however their limitations. The common type I quantum-well-based laser diodes have not exceeded the 4 µm emission yet, whereas quantum cascade lasers (QCLs) have been demonstrated down to 3 µm .Another solution is the so called interband cascade laser(ICL) operational already between 3 and 5 µm, which however, could additionally offer significantly lower power consumption than the QCLs.

There will be discussed the optical properties of InAs/InGaAsSb type II QWsas the active region of ICLs, grown both on GaSband InAs substrates. The focus will be on the possibilities and challenges regarding the extension of the emission range into the longer wavelengths; and active region optimizations aimed at maximizing the optical transition oscillator strength via tailoring the electronic structure and wave function engineering. There will be covered such issues as the band offsets importance, its sensitivity to the layers composition, the active transition intensity versus various structure parameters and external factors as temperature or electric field, and the predominant carrier loss mechanisms.

Biography

Grzegorz Sęk received his PhD from Institute of Physics Wroclaw University of Technology, in Poland in 2001, Habilitation degreee in 2011, and Professor Position in 2012 in the same institute. His research interests concern novel epitaxial nanostructures in view of their optical properties and application prospects, quantum electrodynamics in solid state systems, new semiconducting materials and structures for mid to far infrared photonics, and many-particle physics phenomena in solids, such as Bose-Einstein condensation of exciton-polaritons, and their practical exploitation in optoelectronics. He is an author or co-author of about 150 scientific publications which have been cited more than 1000 times.