

Ion Implantation and Annealing Based Synthesizing of AIII-BV Nanostructures in SiO₂/Si Matrix

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Most of modern electronics manufacturing is based on silicon. But because of its indirect energy band gap silicon cannot be used as an efficient light source. Therefore from economical and technological points of view it is important to find light sources than can be integrated into Si technology.

One of the possible solutions is to integrate AIII-BV semiconductor nanocrystals inside Si-based matrices. For synthesis of such structures sequential ion implantation and annealing techniques can be used. In this work As⁺ + In⁺ and As⁺ + Ga⁺ ions were implanted into SiO₂(100nm)/Si. Flash Lamp Annealing (FLA) in the ms range with preheating was employed within a wide range of annealing parameters such as temperature and time. In that way different sizes of InAs and GaAs nanocrystals were obtained.

To investigate optical properties of InAs and GaAs structures we used low-temperature photoluminescence (PL) and micro-Raman spectroscopic techniques including 2D mapping. PL spectra were obtained in a temperature range from 10K up to RT. Raman spectroscopy was performed at room temperature. The Raman spectra confirms very good quality of InAs and GaAs crystals, and deconvoluted PL spectra give interesting information about expected quantum size effect - related blue shift and nanocrystals sizes.