

Nanocomposites and nanomaterials

Photoelectric properties of InAs/InGaAs quantum dot structures with different stoichiometry of InGaAs metamorphic buffer

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To vary the emission range of nanostructures with InAs quantum dots (QDs), change of the metamorphic $\text{In}_x\text{Ga}_{1-x}\text{As}$ embedding layer stoichiometry is widely used. Photoelectric and photoluminescence (PL) properties of InAs/ $\text{In}_x\text{Ga}_{1-x}\text{As}$ QD structures with $x = 0.15, 0.24, 0.28$ and 0.31 were studied in this work.

An increase in indium content redshifts the PL band; however, its peak position for higher x is found to be blueshifted with increase in the power of 405 nm excitation at 77 K. Lateral photoconductivity spectra were measured at 77 K. The bands related to QD, InGaAs buffer and GaAs substrate band-to-band absorption are observed in the spectra. Furthermore, the features below the QD response energies manifest on the curves. The lowest-pumping curves have an onset at 0.82 eV, this can be attributed to the EL2-like centers. Lower-energy features at 0.74 eV and near 0.6 eV are notable on the curves of higher pumping.

Furthermore, a set of deep electron traps located 0.18-0.19, 0.22-0.23, 0.30-0.33, 0.38-0.40, 0.42-0.43, 0.47-0.48 and 0.52-0.54 eV below the conduction band was found from the thermally stimulated conductivity (TSC) spectra and attributed to the standard structure defects inherent in GaAs (InGaAs). Variation of TSC excitation conditions allowed to conclude that the defects mostly related to the QDs embedded into InGaAs metamorphic buffer. The minimal In content is found to reduce the defect amount compared with the structure on GaAs buffer, however, the defect amount increase with x .