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Polarization mode switching and tuning in p-AlGaAs/GaAsP/n-AlGaAs diodes by compressive stress

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We performed a set of experiments and numerical calculations on strained *p*-$Al_xGa_{1-x}As/GaAs_{1-y}P_y$/n-$Al_xGa_{1-x}As$ hetero-structures under uniaxial stress. These structures are widly used in commercial laser diodes emitting at 766-808 nm. The results show that polarization of emitted light can be extremely sensitive to external uniaxial stress due to the change of wave functions and optical transitions between the subband levels in the quantum well. The increase of applied uniaxial compression leads to the strong change of the energy spectrum of light (LH) and heavy (HH) holes. At zero external compression the uppermost level h1 is a pure LH state and the next level h2 is a pure HH state. While the compression increases the HH state is admixed to LH one. Finally the share of HH state becomes dominated on level h1. So the topmost level h1 becomes almost of HH nature. These changes in the topmost state of the QW remove the prohibition on the interband transitions to occur only in the TM mode. The results of calculations for the experimentally investigated structure demonstrates that in the 14 nm quantum well with phosphor fraction of 0.16 the ratio g_{TM}/g_{TE} of optical gain in the TM and TE modes at zero compression is equals to 8. Under compression P = 5.1kbar in [110] direction the g_{TM}/g_{TE} ratio strongly drops to 1.6 that is in a good agreement with the experimental data with about 5% of variance.

Biography

K I Kolokolov has completed his PhD from Lomonosov Moscow State University and Post-doctoral studies at NASA Ames Research Center. He is a Research Scientist at Lomonosov Moscow State University and Developer of the Hetero-structure Design Studio software. He has published more than 33 papers in reputed journals.

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