Effects of 1-MeV Electron Irradiation on the Photoluminescence of GaInNAs|GaAs Single Quantum Well Structure

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Minimizing the impact of radiation-induced degradation in dilute nitride based optoelectronic devices is crucial in its applications. The effects of 1-MeV electron irradiation (of $1 \cdot 10^{14}-1 \cdot 10^{16}$ e/cm^2 range) on undoped GaInNAs|GaAs single quantum-well (QW) structure has been studied by low-temperature photoluminescence (PL). PL spectra of GaInNAs|GaAs QW are measured before and after electron irradiation. The results show a slight enhancement of the PL intensity in relatively low electron fluence, and then subsequent deterioration of PL with the increase of cumulative electron fluences. The enhancement in PL intensity at low electron doses is explained by recombination-enhanced defect reaction model, and the degradation at high electron doses is explained by irradiation-induced defects in the lattice.

Keywords: dilute nitride, quantum well, electron irradiation, PL, defect.

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