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Title:Characterization of low temperature InGaAs-InAlAs semiconductor photo mixers at 1.55 mu m wavelength illumination for terahertz generation and detection

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Abstract:The structural, optical, and electrical properties of undoped and Be doped lattice matched InGaAs-InAlAs multiple quantum well structures, grown by molecular beam epitaxy (MBE) at low (similar to 250 degrees C) and normal (similar to 450 degrees C) growth temperatures, have been investigated in detail. Double crystal x-ray diffraction studies showed that the thickness of the low temperature (LT) grown quantum well (QW) layers decrease with post growth annealing, while the normal temperature grown QW layers retain their initial thickness. This behaviour is associated with the As precipitation and is the first evidence and report of a direct observation of this phenomenon in LT InGaAs-InAlAs QWs. Room temperature photoluminescence (PL) measurements revealed signs of optical activities in the LT undoped and lower doped structures suggesting that the native defects in LT InGaAs-InAlAs are not sufficient to completely inhibit band to band recombination. Optimal combination of doping, including a modulation doped structure, and post growth annealing temperature results in materials with sub-picoseconds lifetimes (<200 fs) and a resistivity of similar to 10(7) Omega/sq, which is a high value for this material. The results imply the possibility of fabricating efficient photo-mixers operating at the telecom wavelength of 1.55 mu m for THz imaging or other optoelectronic applications. (C) 2012 American Institute of Physics. [http://dx.doi.org/10.1063/1.4719052]

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