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Design of MWIR Type-II Superlattices for Infrared Photon Detectors[1]

CHRISTOPH GREIN, University of Illinois at Chicago

The Type II InAs/GaInSb and InAs/InAsSb superlattices are material systems for implementation as photodetector absorbers in infrared imaging applications. In addition to cutoff wavelengths spanning the infrared spectrum, they offer degrees of freedom in their materials design (e.g. layer thicknesses, alloy compositions, number of layers in one superlattice period) that permit the optimization of an infrared photon detector's figures of merit such as detectivity through the tuning of material properties like generation/recombination lifetimes and optical absorption. We describe efforts to obtain accurate electronic band structures of superlattice semiconductors with infrared energy gaps, and employing them to evaluate nonradiative minority carrier lifetimes. Simple device models are utilized to suggest potential performance enhancements that arise from employing superlattices as infrared absorber. We also discuss current efforts to simulate the molecular beam epitaxial growth of InAs/InAsSb superlattices to predict dominant native point defects and other growth nonidealities.

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