RECENT ADVANCES IN VLWIR TYPE-II SUPERLATTICE PHOTODIODES

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ABSTRACT

Two different approaches to designing and growing $InAs/In_xGa_{1-x}Sb$ superlattices for VLWIR photodiodes will be discussed. The one approach uses InAs/GaSb superlattice materials while the other uses 23% indium in $InAs/In_xGa_{1-x}Sb$ superlattices. These superlattices have been characterized as both photoconductors and photodiodes. The designed structures have been tailored with cut-off wavelengths from 5 to 24 microns. Photoresponse spectra show excellent agreement with the calculated absorption spectra for the different superlattice designs. The superlattice period variation across a 2" wafer is less than 1%, and the band edge transition varied by only 10.8 meV from intitiation to saturation for a photodiode with band gap of 48 meV. Both of these measurements demonstrate the excellent growth control and repeatability of the thin superlattice layers that is currently achievable in these materials through growth by molecular beam epitaxy. Initial responsivity and detectivity measurements for these materials will be presented, as well as the results of detailed materials characterization studies such as AFM, TEM, x-ray diffraction and photoresponse. Studies on substrate alternatives to the standard (100) GaSb will also be included. This paper will review of the current status of VLWIR type-II superlattice materials and detectors.