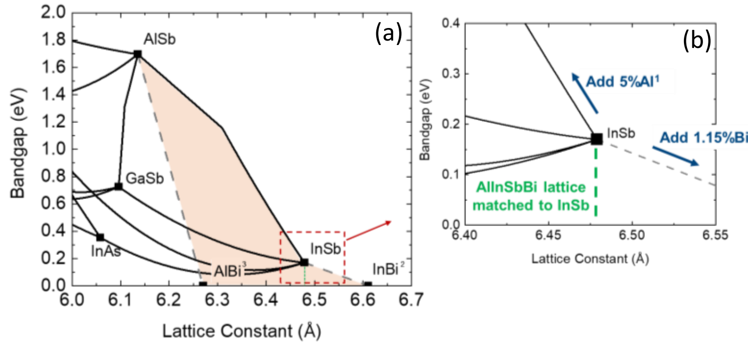

Figure 1(a): Bandgap versus lattice constant plot with the quaternary space of AlInSbBi highlighted, (b) the green dashed line shows where AlInSbBi is lattice matched to InSb and demonstrates the ratio of Al and Bi concentrations required to remain lattice matched.

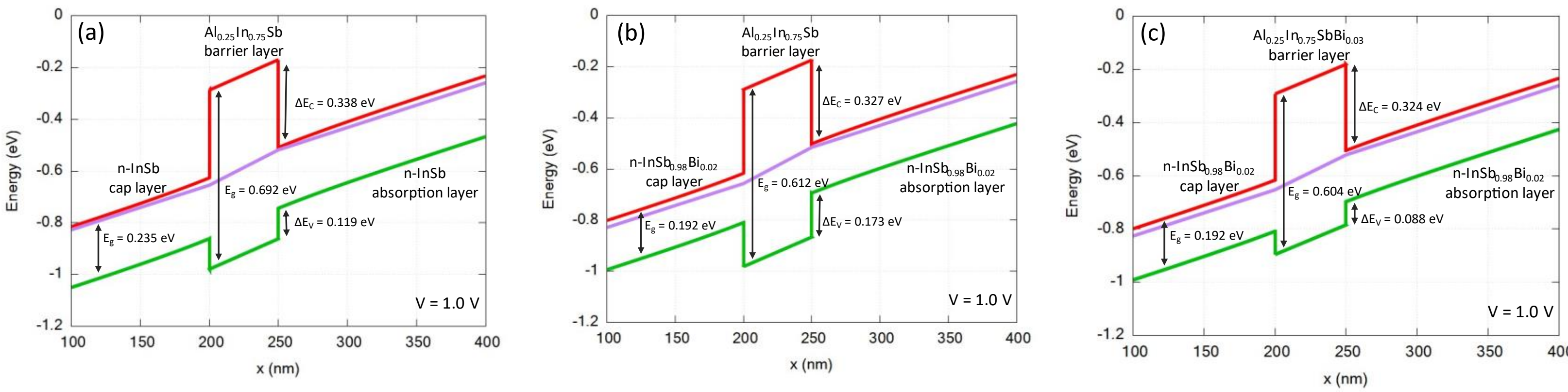

Figure 2: Biased nextnanomat simulations of (a) an InSb-based LWIR nBn structure with InSb cap and absorber layers with light n-type doping (note: InSb cannot access the LWIR), where the AlInSb barrier layer provides a conduction band offset that blocks majority electrons, and the undesirably large valence band offset negatively impacts device performance, (b) nBn with InSbBi cap and absorber layers, where the addition of Bi into InSb enables LWIR detection, and the AlInSb barrier layer, where both the majority electrons and minority holes are blocked, and (c) nBn with InSbBi cap and absorber layers, and incorporating Bi into the AlInSb barrier layer improves the nBn structure by decreasing the valence band offset and minimally affecting the desired conduction band offset.

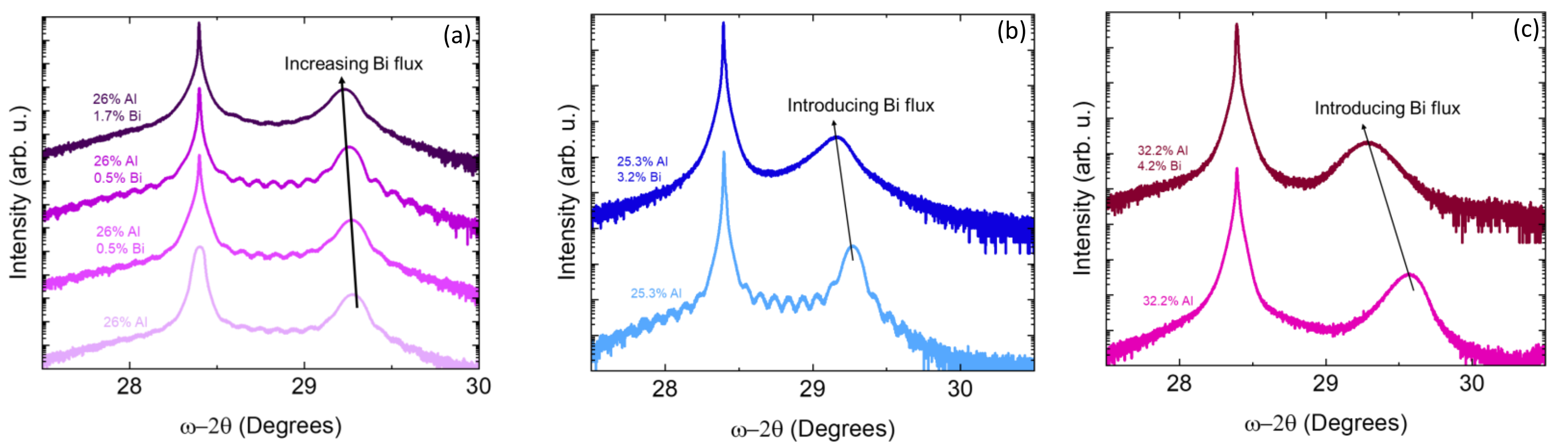

Figure 3(a): X-ray Diffraction (XRD) ω-2θ measurements of 50nm AlInSbBi films grown at 300ºC with a constant Al flux and an increasing Bi flux, where Al concentration is simulated from ω-2θ and Bi concentrations were found from Rutherford Backscattering (RBS) measurements.

Figure 3(b): XRD ω-2θ measurements of 50nm AlInSb and AlInSbBi films grown at 300ºC with a constant Al flux, where Al concentration is simulated from ω-2θ and Bi concentrations were found from Rutherford Backscattering (RBS) measurements.

Figure 3(c): XRD ω-2θ measurements of 50nm AlInSb and AlInSbBi films grown at 300ºC with a constant Al flux, where Al concentration is simulated from ω-2θ and Bi concentrations were found from Rutherford Backscattering (RBS) measurements.

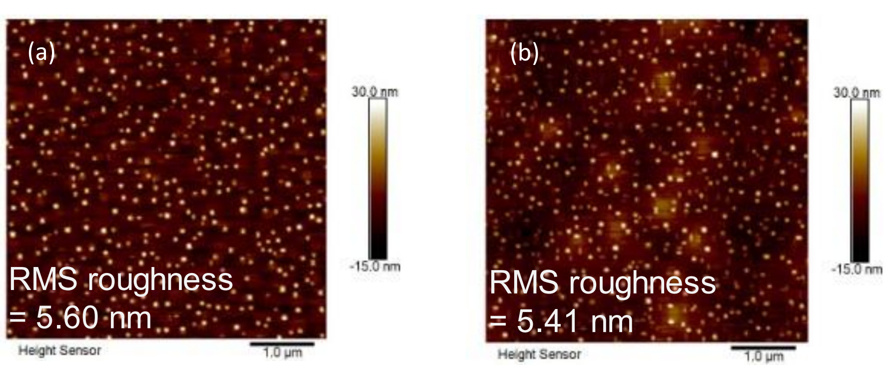

Figure 4(a): Atomic force microscopy (AFM) image of AlInSbBi grown with 25.3% Al and a high Bi flux, and (b) AFM image of AlInSbBi grown with 32.3% Al and a high Bi flux. The light brown spots are Bi droplets, indicative of excess Bi precipitating out onto the surface of the film rather than incorporating into the film under the current (non-optimized) growth conditions.