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Lattice matched quaternary alloy, BGaAsBi: growth and characterisation[1] DANIEL BEATON, AARON PTAK, KIRSTIN ALBERI, ANGELO MASCARENHAS, National Renewable Energy Lab — The ternary semiconductor alloy $GaAs_{1-x}Bi_x$ has been been the focus of many recent studies due to the large decrease in the fundamental bang gap, $\Delta E_g \simeq -85\ meV/\%$ for small incorporated amounts. However, the large size of the bismuth atom relative to the arsenic it replaces results in significant lattice mismatch to GaAs substrates. We now report on the lattice matched quaternary alloy, $B_yGa_{1-y}As_{1-x}Bi_x$. Incorporating a smaller atom (boron) along with the larger atom (bismuth) allows for a reduction of the epi-layer strain and lattice matched compositions, [B]:[Bi]$\simeq$ 1. The benefit of the choice of boron is that it does not effect the band structure of the host GaAs; no change in the band gap is observed with increasing boron content. Samples were grown by molecular beam epitaxy under conditions conducive to bismuth incorporation: low growth temperatures and low V:III ratios. Both high-resolution X-ray diffraction (XRD) and secondary ion mass spectroscopy were used to verify material composition and photoluminescence used to measure the band gap, and these results will be presented. The increasing observation of a distribution of shallow, in-gap boron related defects will also be discussed.

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