ABSTRACT:

We have grown and investigated the band-structure properties of novel III-V alloys based upon BxGa1-xP. These layers are utilized as strain-compensating layers for the lattice-matched integration of novel direct bandgap Ga(NAsP) quantum well lasers on silicon. Experimental and theoretical studies reveal the dependence of the direct and indirect band gaps for strained BxGa1-xP layers grown on silicon as a function of Boron composition from which we derive the properties of free-standing BxGa1-xP. For Boron fractions up to 6%, we find that the bowing parameter for the lowest (indirect) band gap is -?6.2?±?0.2 eV. High crystalline quality and promising optical material properties are demonstrated and applied to monolithically integrated Ga(NAsP)/(BGa)P multi-quantum well heterostructures on (001) silicon substrates. Our results show that novel (BGa)P layers are suitable for strain compensation purposes, which pave the way towards a commercial solution for the monolithic integration of long term stable laser diodes on silicon substrates.