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Strain analysis and electronic structure of short-period strain-balanced $GaAs_{1-x}N_x/InAs_{1-x}N_x$ superlattices lattice-matched to InP(001) L. BHUSAL, A. ALEMU, A. FREUNDLICH, University of Houston — A theoretical strain analysis and investigation of the electronic band structure in the vicinity of the Γ-point of $GaAs_{1-x}N_x/InAs_{1-x}N_x$ short period superlattices strain-balanced to (001) InP is performed. Conditions for strain balancing to create nearly zero strained superlattice on InP is developed by minimizing the total strain energy of the system. A six-band Kane Hamiltonian and a band anti-crossing model, modified for the strain effects are used to describe the electronic states of the highly strained zincblend $GaAs_{1-x}N_x$ and $InAs_{1-x}N_x$ ternaries. The evolution of the conduction band minima and valence subbands maxima of $GaAs_{1-x}N_x$ and $InAs_{1-x}N_x$ as a function of the nitrogen composition (x<0.05) indicate the occurrence of a type I band alignment for the superlattice involving the $m_j = \pm 3/2$ valence subbands and a type II band alignment for the one that involves the $m_j = \pm 1/2$ valence subbands. Room temperature operating wavelengths, as characterized by the energy gap between the first electron miniband and hole minibands,of these short period superlattices are predicted to extend beyond 3 μm for x =0.05.

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