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Electronic Band Structure Investigation of $GaP_{1-x}N_x/GaAs_{1-x}N_x$ Superlattices Lattice-matched to Si WENKAI ZHU, LEKHNATH BHUSAL, ANDENET ALEMU, ALEX FREUNDLICH, Texas Center for Advanced Materials, University of Houston, Houston, TX, USA. — Strain-balanced $GaP_{1-x}N_x/GaAs_{1-x}N_x$ short period superlattices can be lattice-matched to the most commonly available Si substrate for many optoelectronic devices. The theoretical investigation of the electronic band structure in the vicinity of the Γ-point of this superlattices strain-balanced to Si(001) is performed using a transfer matrix method. A six-band Kane Hamiltonian modified with the strain effect and a band anti-crossing model are used to describe the electronic states of the highly strained zinc blende $GaP_{1-x}N_x$ and $GaAs_{1-x}N_x$ ternaries. The evolution of the conduction band minima and valence subbands maxima of $GaP_{1-x}N_x$ and $GaAs_{1-x}N_x$ as a function of the nitrogen composition indicate the occurrence of a type I band alignment for the superlattice involving the $m_j = \pm 3/2, \pm 1/2$ valence subbands (both hole and electron wells in $GaAs_{1-x}N_x$). The room temperature energy gap between the first electron miniband and the first hole miniband of these short period superlattices is predicted to cover the range of band gap from 1.5eV to 1.8eV.

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