Optoelectronic Performance of Vertical Cavity Surface Emitting AlGaAs/GaAs QW Laser in Non-Conventional Orientation

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Abstract

This paper attempts to address a comprehensive in-depth study on the orientation-dependent optoelectronic performance and power-current profile of lattice matched 670nm Al0.3Ga0.7As/GaAs Single QW Vertical Cavity Surface Emitting Laser (VCSEL) in MATLAB by solving an eight-band k.p Hamiltonian using finite difference method at Γ-point. The analysis is done along conventional (100) as well as non-conventional (110), (111), (113) and (131) crystal orientations. It is seen that there is a substantial correlation of the energy band dispersion profile and peak gain with change of crystal orientation due to change in energy splitting between conduction band to heavy and light hole. Highest optical gain, maximum optical power and minimum threshold current is obtained in (111) crystal orientation. This numerical result demonstrates that (111)-oriented epilayer can be incorporated into the active region of this laser system in order to attain improved performance for ultrahigh speed lightwave communications technology.
References

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Index Terms

Computer Science

Applied Sciences
Keywords

Crystal Orientation, Surface emitting laser, AlGaAs, Hamiltonian Matrix, Valence Band, Optical Gain