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Characteristics of 850-nm InGaAs/AlGaAs Vertical-Cavity Surface-Emitting Lasers

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Abstract

The vertical-cavity surface-emitting lasers (VCSEL) operating in the spectral range near 850 nm usually utilize GaAs/AlGaAs as the active layer materials. In this work, in addition to the traditional unstrained GaAs/AlGaAs semiconductor laser, the characteristics of the strained InGaAs/AlGaAs vertical-cavity surface-emitting laser and the distributed Bragg reflectors (DBR) used in this semiconductor laser are investigated with a PICS3D (abbreviation of Photonic Integrated Circuit Simulator in 3D) simulation program. The simulation results show that the strained InGaAs/AlGaAs VCSEL has a better optical performance than that of the traditional unstrained GaAs/AlGaAs VCSEL. That is, when compared with the unstrained GaAs/AlGaAs quantum well structures, the strained InGaAs/AlGaAs VCSEL has a higher stimulated recombination rate, a lower threshold current, a higher main-side mode suppression ratio, and a higher characteristic temperature, which might be owing to its narrower well width and smaller carrier effective masses.