CHAPTER 7

Conclusion

The study on optical confinement mechanism of ridge waveguide structure for laser diode application is accomplished. The optically confinement mechanism is provided to a qualitative understanding. The effective refractive index approximation is used to analyze and design dielectric waveguide where attention is concentrating on index-guiding mechanism. This method also provides confinement factor which is the fraction of the optically mode intensity contained in the waveguiding layers. Some transverse structures such as DH, LOC and SCH are analyzed. The residual upper-cladding layer thickness is introduced to design these structures in wing regions of ridge waveguide structure. The ridge waveguide being lateral structure is calculated as functions of lateral index step and ridge width. The design curves of various transverse structures are established to achieve single transverse mode operation. The optimum parameters, such as the residual thickness of 0.35 μm, the lateral index step of 0.002 and the ridge width of 4 μm, are carried out from the design curve for a DH structure consisting of an 0.1 μm active layer.

Moreover, the ridge waveguide is applied to a DH laser diode so as to investigate performances of index-guiding in lateral directions obtained from the ridge. The ridge waveguide laser diodes are fabricated in semiconductor device research and laboratory (SDRL) by liquid phase epitaxy (LPE) growth and wet-chemically etching. The fabricated chips consist of an 0.2 μm active layer, 0.35 μm residual thickness and 4 μm ridge width. The laser spectrum shows the stimulated emission wavelength at 864 nm. The threshold current ranging from 120 to 150 mA and the differential quantum efficiency ranging from 2.5% to 3.6% are achieved from the chips with 500-600 μm cavity length.