

## [I-6] [초청]

### Molecular beam epitaxy growth and characterizations of ZnSe-based epilayers for blue/green laser diodes

Moon-Deock Kim, Min-Hyon Jeon, Hae-Sung Park, Bong-Jin Kim, Jeong-Keun Ji, Eun-Soon Oh, Sang-Dong Lee, Tae-Il Kim

*Photonics Semiconductor Lab., Materials & Devices Research Center, Samsung Advanced Institute of Technology, P.O. Box 111, Suwon, Korea 440-600*  
*TEL +82-2-331-280-9131, FAX +82-331-280-9357, E-mail mdkim@saitgw.sait.samsung.co.kr*

Much effort has been devoted in recent years to studies on wide-gap II-VI semiconductor heterostructures to realize blue-green laser diodes(LDs). Several groups have by now demonstrated room temperature continuous wave(CW) operation of devices with emission at or near 520 nm using essentially identical structures.[1-3] This structure consists of a both ZnMgSSe and ZnSSe lattice-matched to GaAs, cladding and guiding layers respectively, with a compressively strained ZnCdSe QW, ZnSSe graded, and ZnSe/ZnTe superlattice p-type contact. In this letter, we describe CW operation of a blue-green LD at room temperature.

The LD structure shown in Fig.1 was grown on a (100) silicon doped GaAs substrate using molecular beam epitaxy(MBE) at a growth temperature of 280°C. The designed bandgap energies of the ZnCdSe and the ZnMgSSe are 2.53 and 2.96 eV at 11 K respectively. The bandgap energy difference between the active and cladding layers is thus 0.43eV at 11 K. Gain-guided lasers were fabricated. The p-ZnSe/ZnTe superlattice ohmic layer was chemically etched off with a remaining 10 μm-wide mesa stripe region. An insulating layer was deposited on the open stripe region for reduction of the current path. Pd/Pt/Au multilayer metal was evaporated as a p-electrode on the p-type ZnTe top layer. Au/Ge metal serves as an n-electrode to the n-GaAs substrate. The wafer was cleaved into 800 μm stripes, on whose facets high reflectivity coating was made. The reflectivities were 70 % for the front and 95 % for the rear facet. The strips were then cleaved into 800 μm width pellets.

Figure 2 shows the light output against injection current(L-I) characteristics of the laser diode at room temperature(296 K) measured under continuous and pulsed-current conditions. The threshold current( $I_{th}$ ) under continuous current is 50 mA corresponding to a threshold current density  $J_{th}$  of 890 A/cm<sup>2</sup>. The voltage at lasing threshold is 9 V. The emission spectra taken at room temperature are shown in Fig. 3. The Stimulated emission is observed at wavelengths of 524 nm under pulsed operation and 526 nm under pulsed and continuous operation, respectively.

In conclusion, we achieved the CW operation of blue-green laser diodes at room temperature with the emission wavelength of 526 nm. A threshold current of 50 mA was obtained under CW operation from the ZnCdSe/ZnSSe/ZnMgSSe SQW-SCH structure.

#### References

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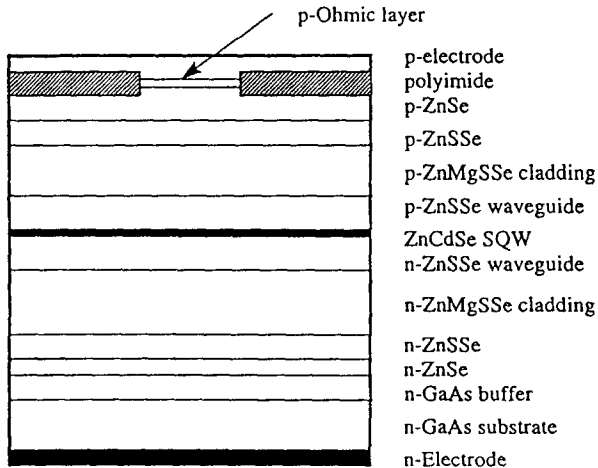


Fig. 1. Schematic structure of ZnCdSe/ZnSSe/ZnMgSSe SQW-SCH laser diode.

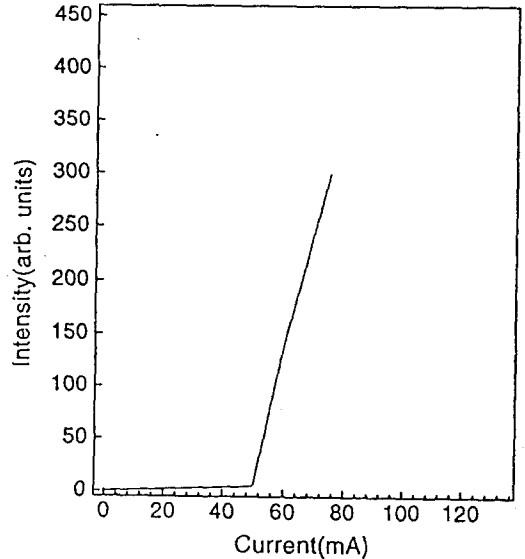


Fig. 2. L-I characteristics under continuous current operation of ZnCdSe/ZnSSe/ZnMgSSe laser diode at room temperature.

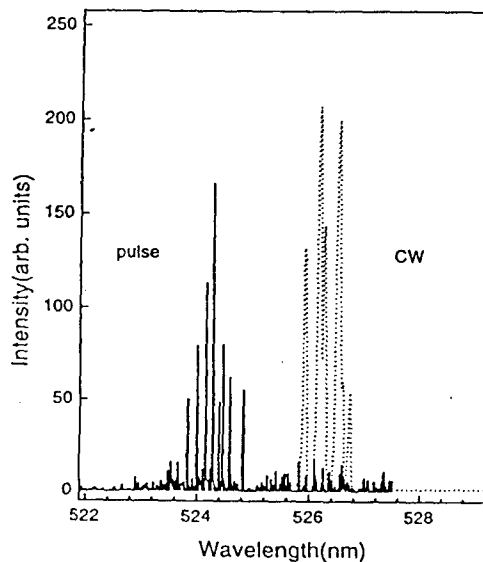


Fig. 3. Emission spectra of ZnCdSe/ZnSSe/ZnMgSSe SQW-SCH laser diode operating under pulsed and continuous wave.