

LD-6-3

LOW THRESHOLD CURRENT OPERATION FOR 0.65 μ m InGaAsP/GaAsP VISIBLE LASER DIODE

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0.6 μ m band visible laser diodes have many attractive applications as light sources for high density optical information-processing systems use as well as optical communications use with plastic fibers whose minimum loss exist in 0.65-0.66 μ m wavelength region. However, the threshold current densities J_{th} , so far reported, is considerably high; 119 KA/cm² for 0.621 μ m InGaAsP/GaAsP LD¹⁾ and 32KA/cm² for 0.66 μ m InGaAlP/GaAs LD.²⁾ These values are too high to achieve room temperature cw operation. This paper reports low threshold current operation for 0.65 μ m InGaAsP/GaAsP LD.

Figure 1 shows an SEM cross section of DH wafer grown by hydride-transport vapor phase epitaxial (HT-VPE) method using the dual-growth-chamber-reactor.³⁾ Epitaxial layer qualities has been improved by optimizing the growth conditions, such as, growth temperature and epitaxial layer lattice constant.

Planar stripe (PS) and mesa stripe (MS) laser structures were fabricated. Basic characteristics of these samples were measured at pulsed condition. Lasing wavelength was 0.65-0.66 μ m as shown in Fig.2. Threshold current densities J_{th} are shown in Fig.3 as a function of the stripe width. Current spreading reduction in MS LD decreased J_{th} to the average value of 9KA/cm² and the lowest value of 5.6KA/cm² resulted in the lowest threshold current of 100mA. Temperature dependence of L-I curve is shown in Fig.4. Characteristic temperature T_0 was 85K at around room temperature.

Cw operation up to -27 $^{\circ}$ C was achieved as shown in Fig.5. In spite of the low threshold current, cw operable temperature was relatively low. This can be attributed to the large thermal resistance R_{th} of 100-150 $^{\circ}$ C/W at -200~-50 $^{\circ}$ C. The thermal resistance problem must be solved to realize room temperature cw operation.

In summary, low threshold current density operation as low as 5.6KA/cm² at room temperature and cw operation up to -27 $^{\circ}$ C have been achieved for 0.65 μ m InGaAsP/GaAsP LD. These results give good prospect for room temperature cw operation at 0.65 μ m wavelength region.

Acknowledgement; The authors wish to thank F.Saito, D.Shinoda, S.Matsushita and H.Watanabe for their continuous encouragement in the visible laser diodes development.

References

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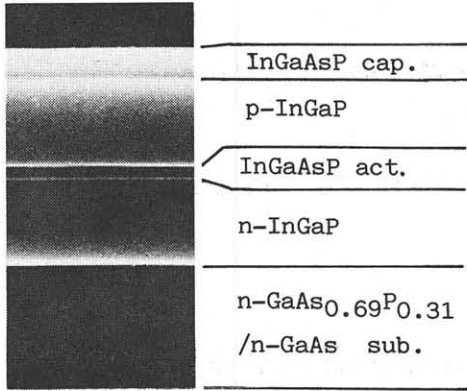


Fig.1 SEM cross section of DH wafer

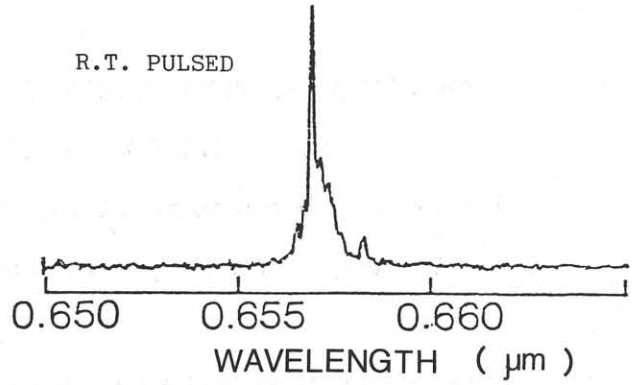


Fig.2 Oscillation spectrum at room temperature

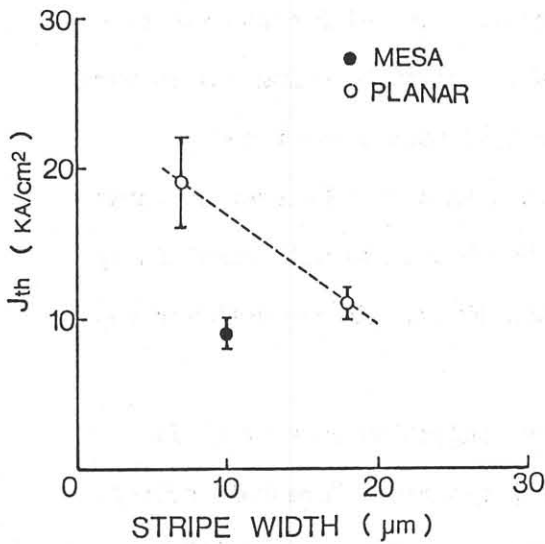


Fig.3 J_{th} of PS and MS LD as a function of stripe width

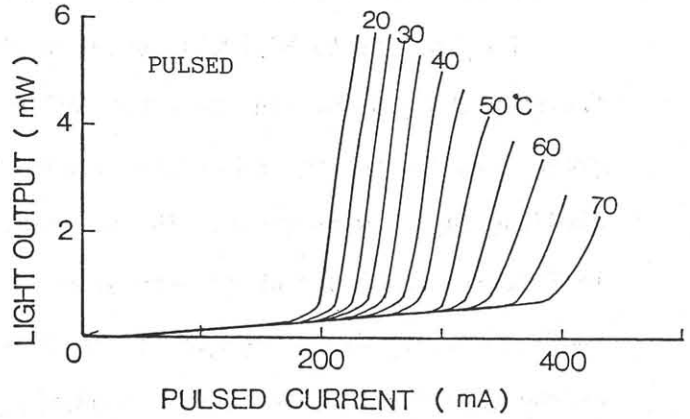


Fig.4 Temperature dependence of pulsed L-I curve

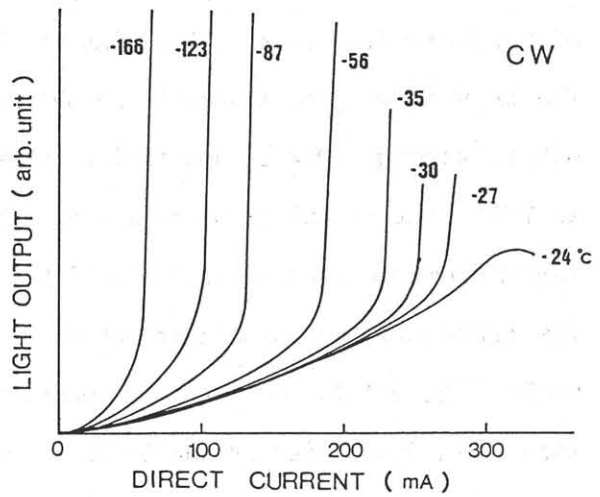


Fig.5 Temperature dependence of cw L-I curve