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626.2 nm PULSED OPERATION (300K) OF AN MOCVD GROWN AlGaInP DOUBLE HETEROSTRUCTURE LASER

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During the past several years, the $(Al_xGa_{1-x})_yIn_{1-y}P$ material system has been studied[1]-[6] to achieve short wavelength (up to 580 nm) visible semiconductor lasers suited for a wide range of applications, such as optical printing and high density information processing systems.

To date, room temperature lasing operation of AlGaInP double heterostructure lasers has been achieved in the 660~680 nm wavelength range by both MBE[4] and MOCVD[5]. There has been, however, no report on AlGaInP lasers operating at shorter wavelength. This is largely due to some difficulties in obtaining high Al composition AlGaInP of good crystalline quality. This paper reports, for the first time, room temperature pulsed operation of an AlGaInP double heterostructure laser at 626.2 nm wavelength.

AlGaInP double heterostructure laser wafers were grown on GaAs substrates by low pressure MOCVD[7], using trimethylaluminum, triethylgallium, triethylindium, AsH_3 and cracked[7] PH_3. H_2Se and dimethylzinc were employed as n- and p- type dopant sources, respectively. The substrate was held on a SiC coated graphite susceptor, which was heated by radio-frequency induction. Reactor pressure during the growth was kept at 70 Torr and growth temperature was about 800 °C. The details of growth conditions are similar to those reported earlier[2],[3],[5],[6]. Special care was taken to prevent O_2 and H_2O contamination in the growth system.

Fgiure 1 shows a cross section view of the laser structure. The double heterostructure was composed of (i) a Se doped n-$(Al_{0.55}Ga_{0.45})_{0.5}In_{0.5}P$ cladding layer ($n\sim2\times10^{17}$ cm^{-3}, $d\sim1.0$ μm), (ii) an undoped $(Al_{0.17}Ga_{0.83})_{0.5}In_{0.5}P$ active layer ($d\sim0.15$ μm) and (iii) a Zn-doped p-$(Al_{0.55}Ga_{0.45})_{0.5}In_{0.5}P$ cladding layer ($p\sim1\times10^{17}$ cm^{-3}, $d\sim1.4$ μm). The structure was formed by two stage MOCVD growth. Current confinement stripe width is 20 μm. Pulse laser operation was achieved at room temperature. Figure 2 shows the emission spectrum from a laser diode operating at 25 % above the threshold current. The lasing wavelength obtained is 626.2nm. Threshold current density is about 50 kA/cm^2. Although the threshold current density is rather high, there is still scope to improve crystalline quality to reduce the threshold current. The present result comfirms that MOCVD grown AlGaInP double heterostrucure lasers are quite promising as 600 nm band visible light sources.

The present research effort is part of a major research and development project on optical measurement and control systems, conducted under a program set up by the Ministry of International Trade and Industry's Agency of Industrial Science and Technology.

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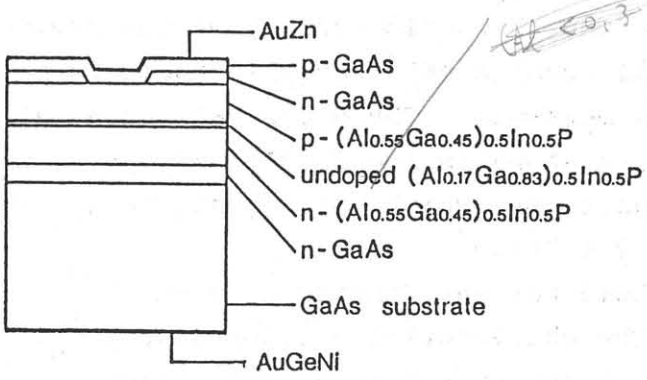

Fig. 1 Cross section view of the laser structure

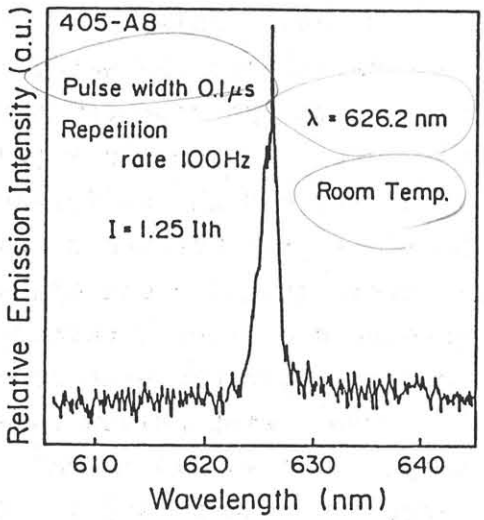

Fig. 2 Emission spectrum