

B-3-2 An Improved Etched Buried Heterostructure Laser with Reduced Threshold Current

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The application of the semiconductor laser for reading-out and recording of video signals or digital data is becoming an urgent developmental subject. The laser should run in a single transverse mode and the aspect ratio of the beam envelope near unity is desirable.

We have developed an improved etched buried heterostructure laser^{1)~4)} for optical read-out purpose. The fabrication process is rather simple. A curved active layer was formed in a V-shaped etched groove by a single run of multi-layer LPE growth; p-GaAs/p-(AlGa)As/p-GaAs active layer/n-(AlGa)As/n-GaAs substrate. It is required that the first n-(AlGa)As covers the whole surface of the substrate to decrease leakage current. The more sharply curved active layer gave the better lateral confinement of optical field. Fig. 1 shows an SEM image of the cleaved facet of the LPE grown wafer. Uniform proton implantation was performed over the wafer in order to form the semi-insulating layer leaving p-GaAs layer in the center of the groove. A groove was etched in the center to reach the remaining p-GaAs layer, and ohmic contact to the p-side was made in the groove (see Fig. 2). This structure is effective for reducing threshold current. The lowest threshold of 23 mA has been obtained for the device 200 μ m in length. The low operating current allowed the laser pellet to be mounted p-side up on a small heat sink.

The transverse mode was usually single and the single longitudinal mode operation was achieved at 1.2 times of the threshold current. Light output power of 10 mW was stably obtained under CW operation. The near field pattern looks circular and the far field beam shows an aspect ratio less than 2.0. Figs. 3, 4 and 5 show current dependence of output power, far field pattern and lasing spectrum, respectively.

Several devices have been operating at 70°C for more than 1000 hr under 4 mW output power condition without significant increase of operating current.

References

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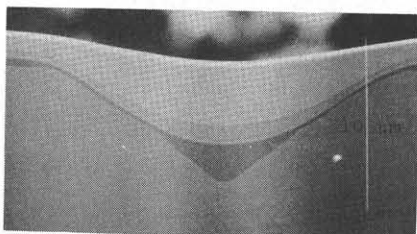


Fig. 1 SEM image of the cleaved facet

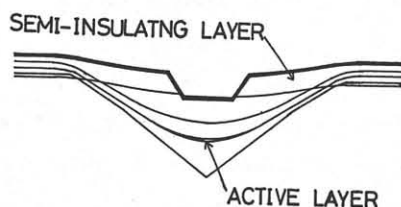


Fig. 2 The schematical cross section of the laser

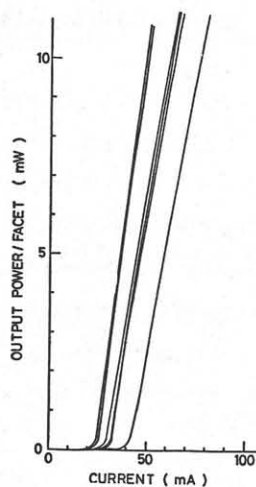


Fig. 3 Current dependence of output power

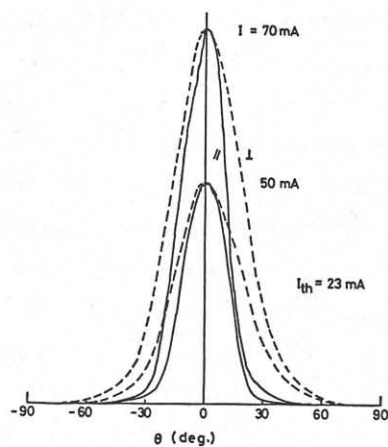


Fig. 4 Far field pattern

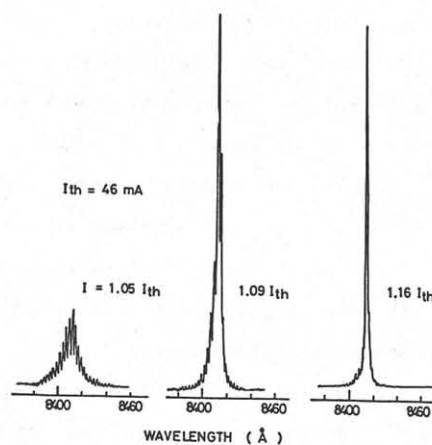


Fig. 5 Current dependence of spectrum