GaInAsP/InP Surface Emitting Laser(II)
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A surface emitting laser is very attractive for lightwave communications as well as optoelectronics, because of their single longitudinal-mode owing to the short cavity, and a sharp beam owing to the wide light emitting area. In the spring meeting this year, a proposal of surface emitting laser and a basic fabrication of surface emitting LED were reported. Here, we report theoretical analysis for the lasing threshold density and surface emitting LED with improved fabrication method.

In Fig. 1, theoretical results on a relation between the threshold current and the mirror reflectivity is shown with parameters of gain coefficient and the active region thickness. A high reflectivity higher than 0.95 is necessary for lasing threshold current density lower than 20 kA/cm².

Until now, in the fabrication of GaInAsP/InP surface emitting LED, a light emitting window was a concave surface owing to the single chemical etching process, which was not suitable for the cavity mirror. This time, a gentle convex surface was realized by applying a double chemical etching. In Figs. 2 and 3, SEM images of the cross section and the etched surface are shown. A quite good mirror surface was obtained. The composition of the active region was Ga₀.₃₅In₀.₆₅As₀.₄₅P₀.₅₄. The thickness and the center emission wavelength were 2.5 micron and 1.22 micron at room temperature, respectively. In Fig. 4, output power vs. injection current characteristics is shown under pulsed current injection. A linear characteristics was obtained up to about 400 mA(20kA/cm²). A near-field image is shown under injection current of 40 mA.