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November 1979 - August 1980

Development of a 1.3-μm-band semiconductor laser (NEC, Hitachi, and Fujitsu)

~ Discrete Semiconductor/Others ~

In addition to the InGaAsP/InP system, the material system that can emit laser light in the 1.3~1.5μm band includes GaAlSb/GaSb, InGaAlAs/InP, etc. Material development was advanced, and finally due to ease of crystal growth etc. InGaAsP/InP system survived.

In the InGaAsP/InP system, there were problems such that the temperature dependency of the threshold current value of the laser oscillation was high and the internal loss of the laser was large due to its energy band structure. For this reason, a buried hetero-structure (BH) laser which confined laser oscillation in a very narrow stripe was invented, and Japanese laser makers (NEC, Hitachi, Fujitsu) succeeded in developing them by each method.

The BH laser has a two-dimensional optical waveguide structure in which a filamentous InGaAsP active layer having a width of 1~2μm and a thickness of 0.1~0.2μm is embedded in an InP crystal. Since the size of the waveguide determines the transverse mode oscillation, control of the filament width (stripe width) is the key in fabrication. FIG.2 shows an example of a process for preparing a BH laser. By utilizing the surface orientation dependence of the etching rate, an inverted triangular mesa is formed. A p-type InP and an n-type InP crystal are epitaxially grown again in the etch-removed part to obtain a buried structure crystal.

Since the buried (BH) structure can reduce the operating current and is also advantageous for thermal radiation, fabrication process technology was actively developed and put to practical use. This structure was actively utilized until a strained quantum well structure was invented and the basic characteristics of the laser were improved later.

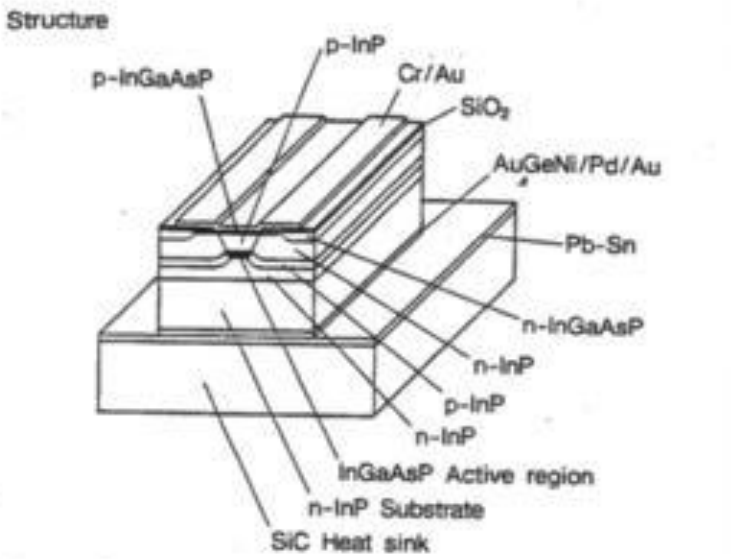

Fig. 1: Structure of InGaAsP/InP BH laser

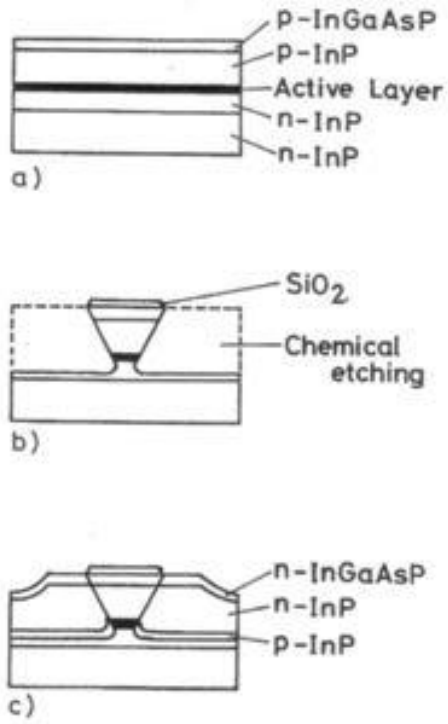

Fig.2: Fabrication process outline of BH laser

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