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STRUCTURE AND CHARACTERISTICS OF MULTILAYER ($GaAs$-$Al_xGa_{1-x}As$) DOUBLE HETEROSTRUCTURE INJECTION LASERS

by

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SYNOPSIS

Double heterostructure (DH) injection lasers, composed of three layers, n-$Al_xGa_{1-x}As$, p-GaAs and p-$Al_xGa_{1-x}As$, were reported by Panish et al.[1] and Alferov et al.[2] At room temperature these DH lasers showed much lower threshold current densities (J_{th}) than any of the homostructure or the single heterostructure (SH) laser diodes.[3-6] In the best group of diodes, J_{th} were as low as about 1 kA/cm^2 for fully internally reflecting modes and about 2 kA/cm^2 for Fabry-Perot modes.[7] However, $Al_xGa_{1-x}As$ has higher thermal resistance than GaAs. In order to obtain a high duty cycle or a continuous operation at high temperatures near room temperature, a multilayer structure was produced. This structure includes a thin (~1μm) p-GaAs active layer (second layer), a thin (1 ~2μm) p-$Al_xGa_{1-x}As$ layer (third layer) and a thin (1 ~2μm) p-GaAs layer (fourth layer).[7] The thin third layer provides a relatively low thermal resistance pass between the active region and a heat-sink which is attached on the top of the fourth layer while providing the required optical and carrier confinement. The purpose of the fourth layer is to produce a low resistance ohmic contact on the diode.

The fabrication and the characteristics of these multilayer structure laser diodes will be discussed.

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