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Characterisation of DH Semiconductor Laser Material

I. J. Dayawansa[1] and J. Sarma[2]
[1] *Dept. of Electronic & Telecom. Eng., University of Moratuwa*
[2] *School of Electrical Engineering, University of Bath, U.K.*

Ion Beam Etching is employed to etch certain regions of the top capping layer in DH Laser diode materiel in the fabrication of stripe-geometry Lasers. It can also be used to etch the cladding layer to such an extent that it will reduce current spreading an inn addition produce index-guiding in stripe-geometry lasers. This requires careful monitoring of the etching process.

A novel monitoring technique was developed for the work. The monitor consisted of two metal contacts deposited on to the top of the capping layer of the DH laser material, leaving a wide gap with parallel edges. A voltage was applied across the metal contacts and the current monitored. An analysis of the dependence of the monitor current on layer thickness and resistivity has been performed. Assuming a constant etching rate the monitor current can be shown to change as the etching process through layers of different resistivity. The layer resistivity is related to the doping concentrations of the various layers. The top capping layer is usually heavily doped in order to produce good metal contacts. Therefore the resistivity of the capping layer is less than that of the next layer. As the etching passed through the top layer and entered the next layer, the rate of decrease of monitor current dropped significantly. When the reached the p-n junction the monitor current fell to zero. These features were observed in tests of a number of material samples and indicated that the technique was suitable for characterising DH laser material. The resistivity and doping concentration of the top capping layer and the next cladding layer were experimentally determined.

Since the monitoring technique is very simple to apply it can be used to carry out controlled etching and thus produce cladding layers of any desired thickness so as to provide an index guiding mechanism for optical confinement.