

High Quality AlGaAs Layers Grown by Molecular Beam Epitaxy at Low Temperatures

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Abstract

Low-temperature (600 °C) molecular beam epitaxy (MBE) growth of AlGaAs has been studied. It was found that the quality of AlGaAs grown at low temperatures can be as good as that grown at high temperatures (>700 °C) if the source materials and the growth chamber are very clean. The threshold currents of Al_{0.6}Ga_{0.4}As/Al_{0.15}Ga_{0.85}As/Al_{0.6}Ga_{0.4}As double heterostructure (DH) lasers grown at low temperatures and high temperatures are almost the same. The material quality can be further improved with a proper amount of indium doping. Photoluminescence (PL) linewidths of 3.1 meV and 1.7 meV have been measured for Indoped Al_{0.42}Ga_{0.58}As and Al_{0.18}Ga_{0.82}As at 4 K, respectively. They are the narrowest linewidths for the MBE-grown AlGaAs with comparable Al contents at any growth temperature. With a proper amount of In doping, double-barrier resonant tunnelling diodes have also shown improved peak-to-valley current ratios.