

Fig. L.16.2 PL Spectra from the nano-crystalline Silicon film

The samples were characterized by AFM. The surface morphology clearly indicates uniform, closely packed Si/SiO_x crystallites (fig.L.16.1). The photoluminescence (PL) spectrum of the samples was obtained using 330nm excitation wavelength, which clearly showed strong luminescence around 375 – 400nm (fig.L.16.2).

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L.17 MOVPE system for epitaxy growth of III-V semiconductor heterostructure

The Metal-Organic Vapor Phase Epitaxy (MOVPE) system (AIX200) has been commissioned for epitaxial growth of III-V semiconductor heterostructures (fig. L.17.1). The precursors available on this machine are arsine, phosphine, trimethyl gallium, trimethyl aluminum and trimethyl indium allowing growth of a large variety of semiconductor structures with Al, Ga, In from group 3 and As and P from group 5. The available dopants precursors are silane, hydrogen selenide and dimethyl zinc. In view of the hazardous properties of the precursors installed on the machine, an effluent handling system (wet scrubber) has been commissioned and tested for its satisfactory performance. Apart from He leak testing and efficient disposal of waste gases, other built in safety systems are installed in the machine. In order to grow the laser diode structure, we need to optimize several growth parameters of MOVPE grown epitaxial layers.

The system has been tested by growing thick undoped GaAs layers. We achieved the background doping for undoped GaAs lesser than 10¹⁵ cm⁻³ and the mobility at 77K was about 65,000cm²/V-Sec. A super lattice structure consisted of AlAs/GaAs materials have been grown for measurement of the thickness uniformity of grown layers (fig.L.17.2). The standard deviation value for a 2-inch substrate was about 2% excluding a 5mm outer ring. A quantum well (QW) structure consisting of a 100Å GaAs QW with AlGaAs barrier was also grown. This QW sample

was characterized by photoluminescence (PL) measurement. The full width at half maximum of 10K PL spectrum was about 8meV. Figure L.17.3 shows a 10K PL spectrum of a multi quantum well (MQW) sample. This sample consists of four GaAs QWs of varying thickness, which are sandwiched between AlGaAs barriers. The quantization effect mainly the shift of PL wavelength with QW size is clearly visible. We have grown InGaP epitaxial layers on GaAs substrates and we observed red luminescence at room temperature. The red luminescence from Al_{0.32}Ga_{0.68}As layers grown on GaAs substrate was observed. Some samples of GaAs and AlGaAs have been grown for the n type doping studies.



Fig. L.17.1 A photograph of MOVPE system

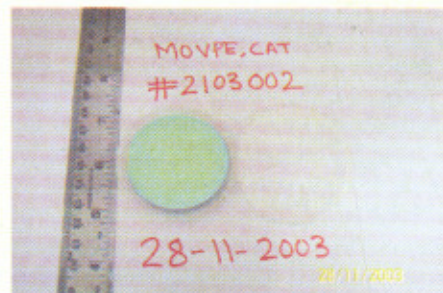


Fig. L.17.2 Samples of AlAs/GaAs layers

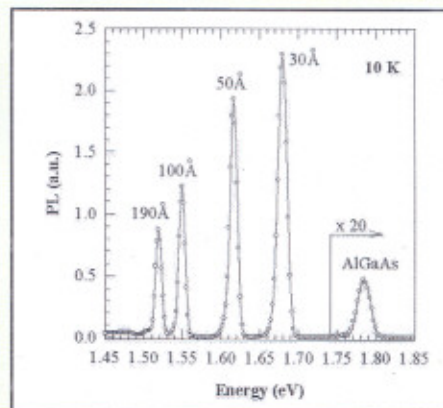


Fig. L.17.3 10K PL spectrum of a MQW sample

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