# 26pB11

## Study on the LPE growth of InGaAs pyramidal layers on (100) GaAs substrates

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Growth of $In_xGa_{1-x}As$ (x=0.06) layers with pyramid like structures on various types of patterned (100) GaAs substrates by liquid phase epitaxy (LPE) has been investigated.

**1. Introduction:** $In_xGa_{1-x}As$ epitaxial layers are known for their detector and thermo-photo-voltaic cell applications in the near IR region. Efficiency of the devices can be improved by having larger surface area of exposure. This could be achieved by having the device surface in the pyramidal shape with four faces. To study the pyramidal growth morphology, $In_xGa_{1-x}As$ (x=0.06) layers were grown on (100) GaAs substrates.

**2. Experimental:** InGaAs layers were grown by conventional LPE system. Three different types of (100) GaAs substrates were used, namely, non-patterned (plane), circular-patterned (trenchless) and circular-patterned (with 40μm trench) substrates. The grown layers were analyzed by different types of microscopes.

**3. Results and discussion:** The filled (not hollow) tent structured InGaAs layers, having {111} planes as their surfaces, were grown on GaAs plane-substrates. This indicates that non-planer InGaAs layer can be grown on (100) GaAs substrate. As it is a filled structure, dislocations can get incorporated into the epilayer from the substrate. Pyramid structured InGaAs layers surrounded by {111} planes were obtained on trenchless substrates, indicating that the circular patterns on (100) GaAs substrate were effective to obtain the layers with larger surface areas. In this case also, the formed pyramid structures were not perfectly hollow or in other words, structures similar to those of bridge layers were not formed. Figure 1 shows the SEM image of InGaAs layer grown on a trench-substrate. The significant aspect in this case is that the formed pyramid like structures were hollow. Figure 2 shows the schematic illustrations of the hollow pyramid structure. These results show that InGaAs bridge type layer can be grown on (100) GaAs trench-substrate also.

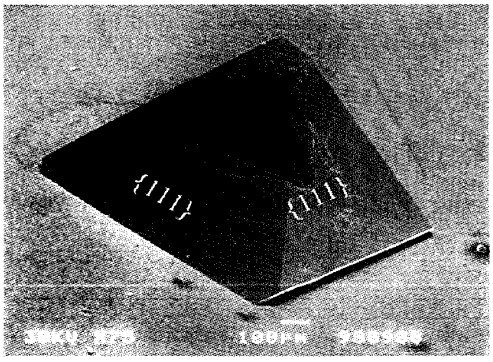


Fig.1

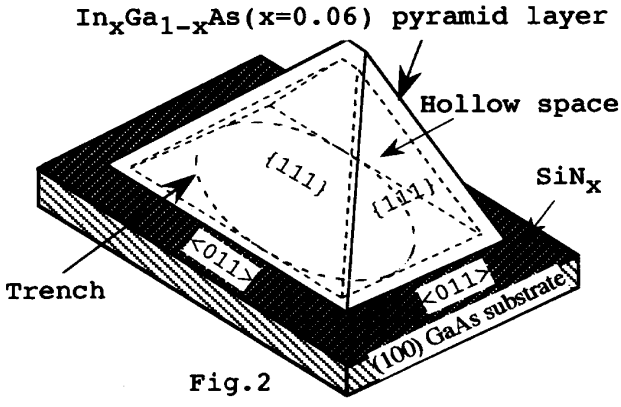


Fig.2

**4. Conclusions:** Filled tent like structures of $In_xGa_{1-x}As$ (x=0.06) were grown on (100) GaAs plane substrates. Non-hollow pyramid shaped InGaAs layers resulted when circular patterned trench-less substrates were used. On the trench-substrates, perfect hollow pyramid structured InGaAs having larger surface area resulted. This growth was similar to that of the bridge layers grown over (111)GaAs trench substrates.