

Diffuse diffracted features in GaInP layers grown by chemical beam epitaxy

(CBE 로 성장한 GaInP 에피 박막의 구조적 특성 연구)

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GaInP lattice matched to GaAs is of increasing interest for its applications as visible light-emitting diodes and lasers. The successful growth of 0.98 μm lasers using GaInP cladding layers has been achieved by chemical beam epitaxy(CBE). CuPt-type ordering generally occurs in OMVPE grown GaInP (001) layers. Although transmission electron microscopy(TEM) has been widely used to investigate ordering in OMVPE GaInP layers, there is obviously a lack of detailed microstructural characterization of GaInP layers grown by CBE. In this work, TEM and transmission electron diffraction(TED) studies of GaInP CBE layers grown on GaAs (001) substrates are presented.

$\text{Ga}_x\text{In}_{1-x}\text{P}$ ($x = 0.5$) layers were grown onto Cr-doped semi-insulating (001) GaAs by CBE using trimethylindium, trimethylgallium and PH_3 . The growth rate was 0.23nm/s and the growth temperatures ranged from 490 to 580 $^\circ\text{C}$. Transmission electron microscopy(TEM), diffraction(TED) and photoluminescence(PL) were used to characterise these layers.

TED examination showed the presence of diffuse scattering at $1/2\{\bar{1}-\delta, 1-\delta, 0\}$ positions and weak $1/2\{111\}$ superlattice spots corresponding to long-range CuPt-type ordered structure. The intensity of diffuse scattering depend on the growth temperature. As the growth temperature increased, the maximum intensity of diffuse scattering progressively approached a position of $1/2\{\bar{1} 10\}$. Diffuse scattering may be explained in terms of short-range order among the mixed group III atoms. Bandgap reduction (18~30meV) was observed in some of the GaInP layers. Such reduction was attributed to the presence of ordered structures.