Binding energy study from photocurrent signal in HgCdTe layers

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Abstract : $Hg_{1-x}Cd_xTe$ (MCT) was grown by hot wall epitaxy. Prior to the MCT growth, the CdTe (111) buffer layer was grown on the GaAs substrate at the temperature of 590 °C for 15 min. When the thickness of the CdTe buffer layer was 5 μm or thicker, the full width at half maximum values obtained from the x-ray rocking curves were found to significantly decrease. After a good quality CdTe buffer layer was grown, the MCT epilayers were grown on the CdTe (111) /GaAs substrate at various temperatures *in situ*. The crystal quality for those epilayers was investigated by means of the x-ray rocking curves and the photocurrent experiment. The photoconductor characterization for the epilayers was also measured. The energy band gap of MCT was determined from the photocurrent measurement and the x composition rates from the temperature dependence of the energy band gap were turned out.

Key Words: $Hg_{1-x}Cd_xTe$, Hot wall epitaxy, Photocurrent, Photoconductor

1.Introduction

$Hg_{1-x}Cd_xTe$ (MCT) is an important electro-optical band gap semiconductor for infrared region (IR) detector technology due to the ease of wavelength tunability . In this paper, MCT on the CdTe buffer layer was grown by using a HWE method. Here, the CdTe buffer layers were grown under various growth conditions on the semi-insulating GaAs (100). The crystal quality of the grown MCTs was estimated by means of the powder and the double crystal x-ray diffraction technique. Also, the photoconductor characterization for these epilayers is examined through a photocurrent (PC) measurement.

2.Results and discussion

$Hg_{1-x}Cd_xTe$ was grown by hot wall epitaxy method. The (111) CdTe buffer epilayer was grown on the GaAs substrate at 590 °C for 15 min. Then, MCT epilayers were grown on the grown CdTe buffer epilayer. The grown MCT epilayers were confirmed to be of high quality crystal and the very smooth surface was proven by using DCRC and AFM measurement. From the PC measurement, MCT-1 showed the spectrum range from 1.0 μm to 1.6 μm and the spectral peak wavelength located at 1.1059 μm (1.1220 eV) corresponds to the band gap of the MCT epilayer. The spectrum of MCT-2 was observed within the wavelength range from 3.5 μm to 5.5 μm and its spectral peak was located at 4.0750 μm (0.3043 eV). The x values of composition rate for the MCT-1 and 2 epilayers at 77 K turned out to be 0.762 and 0.317 respectively. Also, the comparatively steep slopes to the right region of the spectral peaks wavelength as shown in Fig. 5 and 6 were thought to be an evidence of the homogeneity of the composition in the surface epilayers. Therefore, these results mean that the grown MCT epilayers can be applied as a photoconductor for infrared region detector.

References

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