P-29

Temperature dependence of photocurrent for $CdGa_2Se_4$ single crystal thin film grown by hot wall epitaxy

홍광준†

조선대학교 물리학과

(kjhong@chosun.ac.kr†)

Single crystal CdGa2Se4 layers were grown on a thoroughly etched semi-insulating GaAs(100) substrate at 420 ℃ with the hot wall epitaxy (HWE) system by evaporating the polycrystal source of CdGa2Se4 at 630 ℃prepared from horizontal electric furnace. The crystalline structure of the single crystal thin films was investigated by the photoluminescence and double crystal X-ray diffraction (DCXD). The carrier density and mobility of single crystal CdGa2Se4 thin films measured with Hall effect by van der Pauw method are 8.27× 10^{17} cm^{-3}, 345 $cm^{2}/V\cdot s$ at 293K, respectively. The photocurrent and the absorption spectra of CdGa2Se4 /SI(Semi-Insulated) GaAs(100) are measured ranging from 293 K to 10K. The temperature dependence of the energy band gap of the CdGa2Se4 obtained from the absorption spectra was well described by the Varshni's relation, $E_g(T) = 2.6400\ eV - (7.721 \times 10^{-4}\ eV/K)T^2/(T + 399\ K)$. Using the photocurrent spectra and the Hopfield quasicubic model, the crystal field energy(Δcr) and the spin-orbit splitting energy(Δso) for the valence band of the CdGa2Se4 have been estimated to be 106.5 meV and 418.9 meV at 10 K, respectively. The three photocurrent peaks observed at 10 K are ascribed to the A1-, B1-, and C11-exciton peaks.

Keywords: CdGa2Se4, energy band gap, photocurrent spectrum, crystal field splitting energy , spin-orbit splitting energy

P-30

Optoelectrical properties for $CuAlSe_2$ epilayers grown by using hot wall epitaxy method

백승남, 홍광준*,†

조선대학교 금속재료공학과; *조선대학교 물리학과

(kjhong@chosun.ac.kr†)

The CuAlSe2(112)/GaAs(100) heteroepitaxial layers were grown by the hot wall epitaxy (HWE) method. From the measurements of the Laue patterns and the double crystal X-ray diffraction, the CuAlSe2 epilayer was confirmed to the epitaxially grown layer along the <112> direction onto a GaAs (100) substrate. The Hall mobility and carrier density of the CuAlSe2 epilayer at 293 K were estimated to be 295 $cm^2/V\cdot sec$ and 9.24 X 10^{16} cm^{-3}, respectively. This mobility is approximately one order higher than the reported value. From the temperature dependence of the Hall mobility, the scattering at a high temperature range was mainly due to the acoustic mode of lattice vibration. The scattering at a low temperature was the most pronounced range due to the impurity effect. From the low-temperature PL experiment, we observed the sharp and intensive free-exciton peak at 2.7918 eV. Also, this peak existed far more in the short-wavelength region than 2.739 eV of free exciton measured from the epilayer grown by the metalorganic chemical vapor deposition (MOCVD). Consequently, these facts indicate that the CuAlSe2 epilayers grown by the HWE method are higher quality crystals than those grown by MOCVD or other methods.

Keywords: Characterization, Hot wall epitaxy,. Semiconducting ternary compounds