

CuInSe₂ 단결정 박막 성장과 광전류 특성Properties of Photocurrent and Growth of CuInSe₂ single crystal thin film

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The stoichiometric mix of evaporating materials for the CuInSe₂ single crystal thin films was prepared from horizontal furnace. To obtain the single crystal thin films, CuInSe₂ mixed crystal was deposited on thoroughly etched semi-insulating GaAs(100) substrate by the Hot Wall Epitaxy (HWE) system. The source and substrate temperature were 620 °C and 410 °C, respectively. The crystalline structure of single crystal thin films was investigated by the photoluminescence and double crystal X-ray diffraction (DCXD). The carrier density and mobility of CuInSe₂ single crystal thin films measured from Hall effect by van der Pauw method are $9.62 \times 10^{16} \text{ cm}^{-3}$, $296 \text{ cm}^2/\text{V} \cdot \text{s}$ at 293 K, respectively. From the photocurrent spectrum by illumination of perpendicular light on the c - axis of the CuInSe₂ single crystal thin film, we have found that the values of spin orbit splitting Δ_{So} and the crystal field splitting Δ_{Cr} were 6.1 meV and 175.2 meV at 10 K, respectively. From the photoluminescence measurement on CuInSe₂ single crystal thin film, we observed free excitation (E_{X}) existing only high quality crystal and neutral bound exciton (D^0, X) having very strong peak intensity. Then, the full-width-at -half-maximum(FWHM) and binding energy of neutral donor bound excitation were 7 meV and 5.9 meV, respectively. By Haynes rule, an activation energy of impurity was 59 meV.