

RF-magnetron sputtering 방법으로 성장시킨 Ga-doped ZnO 박막의 성장 온도 변화에 따른 영향

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Abstract : 1 wt % Ga-doped ZnO (ZnO:Ga) thin films with n-type semiconducting behavior were grown on c-sapphire substrates by radio frequency magnetron sputtering at various growth temperatures. The room temperature grown ZnO:Ga film showed the faint preferred orientation behavior along the c-axis with small domain size and high density of stacking faults, despite limited surface diffusion of the deposited atoms. The increase in the growth temperature in the range between 300 ~ 550 °C led to the granular shape of epitaxial ZnO:Ga films due to not enough thermal energy and large lattice mismatch. The growth temperature above 550 °C induced the quite flat surface and the simultaneous improvement of electrical carrier concentration and carrier mobility, $6.3 \times 10^{18}/\text{cm}^3$ and $27 \text{ cm}^2/\text{Vs}$, respectively. In addition, the increase in the grain size and the decrease in the dislocation density were observed in the high temperature grown films. The low-temperature photoluminescence of the ZnO:Ga films grown below 450 °C showed the redshift of deep-level emission, which was due to the transition from Zn_i to O_i level.