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The content calculation of hexagonal phase inclusions in hexagonal GaN films on GaAs (001) substrates grown by metalorganic vapor phase epitaxy

Hexagonal GaN (h-GaN) films were grown on GaAs (001) substrates by metalorganic vapor phase epitaxy (MOVPE). Two GaN samples were grown with different the thickness of each was 2.35 ± 0.08 and 3.07 ± 0.12 μm , respectively. High resolution X-ray diffraction was used to study the secondary crystallographic phases presented in the h-GaN films. The phase composition of the epilayers was determined by X-ray reciprocal space mapping. The intensities of the c-GaN (002) and h-GaN (10-11) planes detected in the mapping were investigated by ω -scans. To quantify the amount of hexagonal phase inclusions in the h-GaN films with a large thickness, the effects of GaN X-ray absorption and of the diffraction geometry were considered. In this case, the content of the hexagonal phase inclusions in the h-GaN films was calculated to about 85.8 and 93.2% for the thickness of 2.35 ± 0.08 and 3.07 ± 0.12 μm , respectively. However, without correction of the X-ray absorption and the diffraction geometry, the content of the hexagonal phase inclusions was reduced by 2.3% and 1.75%, respectively. Diffraction geometry factor can eliminate the effects of ω angles on the irradiated surface areas for different scattered planes.

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