Characterization of a GaN wafer and a homo-epitaxial layer by synchrotron X-ray topography techniques

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We have investigated the crystal quality of the 2 and 4-inch GaN wafer and homo-epitaxial layer by monochromatic X-ray diffraction topography. GaN (11-24) diffraction images at various incident angles were obtained to determine the image of maximum intensity and full-width at half-maximum (FWHM). [1-3] In addition, we have investigated the local structures of a GaN substrate through an energy-resolved white X-ray diffraction topography method. A section topography geometry was implemented at various sample positions for the purpose of wafer mapping. The obtained images at each position were piled up for the 3D matrix then sliced at a same energy position. The sliced images of the lower and higher diffraction energy showed periodic bottom-less and top-less features originated from the local lattice tilting, respectively.

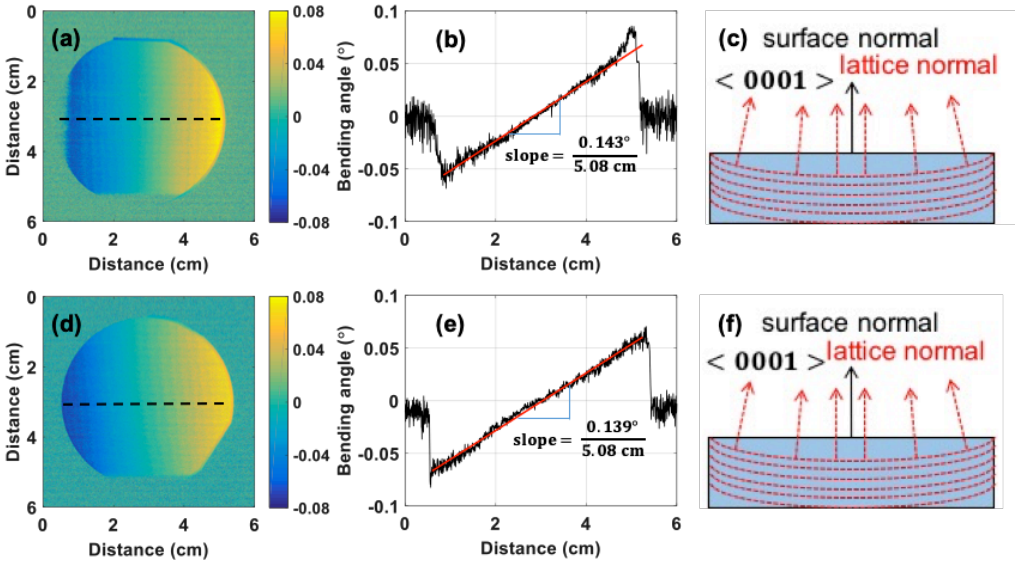

Figure1. Distributions of relative bending angle for a 2-inch GaN layer at (a) azimuth φ=0 and (d) 120°, respectively. We evaluated the distribution of the relative bending angle centered on the θ angle using a stacked image of the GaN layer.

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[2] O. Seo, J. M. Kim, C. Song, Y. Lou, L. S. R. Kumara, S. Hiroi, Y. Chen, Y. Katsuya, Y. Irokawa, T. Nabatame, Y. Koide, and O. Sakata AIP Adv. 8, 075318 (2018)

[3] J. Kim, O. Seo, C. Song, Y. Chen, S. Hiroi, Y. Irokawa, T. Nabatame, Y. Koide, and O. Sakata CrystEngComm 20, 7761 (2018)