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Characterization of InGaN/GaN multiple quantum well structure and its PL spectra in a 2" wafer for GaN green LED

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We investigated the origin of the inhomogeneous distribution of photoluminescence spectra on a 2" wafer for GaN green LED by analysis of x-ray diffraction profile near GaN (0004) Bragg position. The nonuniformity of PL peak wavelength could be explained by the combined effect of QW thickness and indium inhomogeneous distribution. Although the average amount of indium is similar over whole wafer, the thicknesses of quantum well and the stacking period (well+barrier) vary by ~1 Å and ~15 Å, respectively. The increment of quantum well thickness combined with nonuniform indium distribution causes strong red shift of PL peak wavelength as large as 8 nm. As increase of quantum well thickness, PL spectral width also increases by the enhancing nonuniformity of indium content in quantum well region. The inhomogeneous indium incorporation was confirmed by strain filed analysis using TEM.