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Emission and Structural Properties of Titanium Oxide Nanoparticles-coated a-plane (11-20) GaN by Spin Coating Method

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The blue light emitting diode (LED) structure based on non-polar a-plane (11-20) GaN which was coated TiO2 nanoparticles using spin coating method was grown on r-plane (1-102) sapphire substrates to improve light extraction efficiency. We report on the emission and structural properties with temperature dependence of photoluminescence (PL) and x-ray rocking curves (XRC). From PL results at 13 K of undoped GaN samples, basal plane stacking fault (BSF) and near band edge (NBE) emission peak were observed at 3.434 eV and 3.484 eV, respectively. We also found the temperature-induced band-gap shrinkage, which was fitted well with empirical Varshini's equation. The PL intensity of TiO2 nanoparticles ?coated multiple quantum well (MQW) sample is decayed slower than that of no coating sample with increasing temperature. The anisotrophic strain and azimuth angle dependence in the films were shown from XRC results. The full width at half maximum (FWHM) along the GaN [11-20] and [1-100] directions were 564.9 arcsec and 490.8 arcsec, respectively. A small deviation of FWHM values at in-plane direction is attributed to uniform in-plane strain.

Keywords: Nonpolar, GaN, titanium oxide, light emitting diode, metal organic chemical vapor deposition