Study of luminescence properties of InGaN layers with wide-range lateral indium content profiling.

Kyoto University [1], Institute of High Pressure Physics PAS [2], TopGaN Ltd. [3],

◦Anna Kafar[1,2], Ryota Ishii[1], Szymon Stanczyk[2], Krzysztof Gibasiewicz[2], Szymon Grzanka[2,3], Tadeusz Suski[2], Piotr Perlin[2,3], Mitsuru Funato[1], and Yoichi Kawakami[1]

E-mail: anna.kafar@optomater.kuee.kyoto-u.ac.jp

A strong dependence of the indium incorporation on the misorientation angle was reported in the earlier works, e.g. [1]. These results show a promising opportunity to create advanced measurement platforms (various indium contents on one sample) or novel devices like superluminescent diodes with broadened emission spectra. However, there are very little precise studies of the material properties of InGaN layers created on substrates with strongly changing misorientation angle. Especially in with smooth change of indium content in a small scale, such as 40 μm. Within this work, we employ high-resolution micro photoluminescence studies (μPL), to examine how the large change of substrate misorientation angle (from about 0.7° to 4°) modifies the emission properties of the material.

A simple (Al,In)GaN structure with two InGaN quantum wells (QW) was grown on a substrate with laterally modified misorientation angle, according to a dedicated "NICE" method - Nitride-material Indium Content Engineering. The unique three-dimensional patterning (Fig.1) allowed the fabrication of 40 μm areas characterized by the wide range of misorientation angles and, consequently, wide range of indium contents. The μPL mapping proves the indium content profiling, by showing an around 35 nm range of emission wavelength from a single, small measurement area (Fig. 2). However, apart from the emission wavelength variation, we also observe a linear correlation of the intensity of PL signal and the emission wavelength. The effect may be related to indium-content-dependent emission efficiency of InGaN QWs or the deviation form optimal growth conditions for high misorientation angles.

[1] Sarzynski et al., Cryst. Res. Technol. 47, No. 3, 321 – 328 (2012)

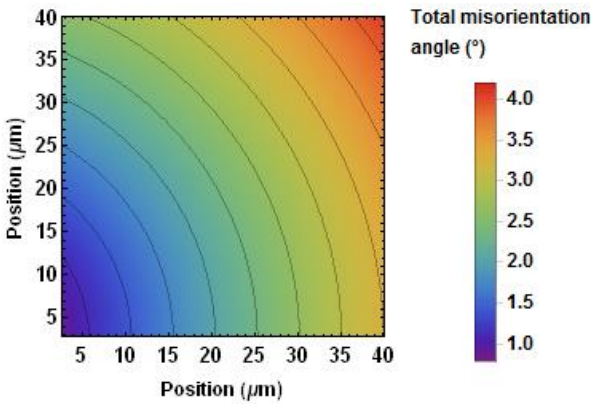

Fig. 1. Map of the misorientation angle distribution.

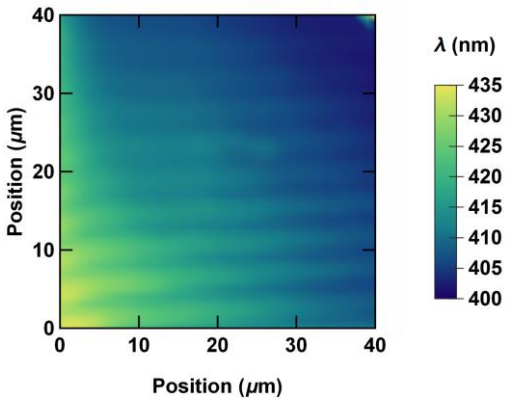

Fig. 2. PL map of the studied area with variable In content.