# InGaN quantum wells with spatially engineered indium content for broadening of nitride superluminescent diode emission spectra

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Nitride superluminescent diodes (SLDs) are a device class that compromises parameters of LEDs and laser diodes – they are characterized by high spatial coherence and low temporal coherence. Thus, SLDs are promising light sources for applications such as picoprojection, fiber optic gyroscopes or optical coherence tomography (OCT). Some of them, like OCT, benefit from as low time coherence (wide emission spectrum) as possible, which triggers advanced engineering of the devices. In this work, we present InGaN quantum wells with spatially modified indium content that can be used as active region of SLDs to broaden their emission spectrum.

A bulk GaN substrate was prepared according to "NICE" procedure – Nitride-material Indium Content Engineering [1,2], which allowed fabrication of 3D patterns on the crystal surface that modified the local substrate misorientation angle. This change influenced the indium incorporation during the epitaxial growth and lead to obtaining blue-violet InGaN quantum wells with spatial variation of emission wavelength.

Micro photoluminescence study of the sample showed clear shift of emission wavelength according to our designed distributions. The test areas with sizes of around 40 x 40 μm were characterized by a smooth emission shift of from 20 nm to even 35 nm (Fig.1) depending on the excitation level and the surface pattern shape. The local indium content was studied by Energy Dispersive X-Ray analysis with scanning transmission electron microscopy and scales very similarly to the emission wavelength, which directly confirms indium content modification by substrate misorientation.

Different surface pattern shapes were examined and showed modification of the emission properties according to the local total misorientation angle, which proves the flexibility of the presented approach and suggests similar indium incorporation mechanism for a- and m-direction.

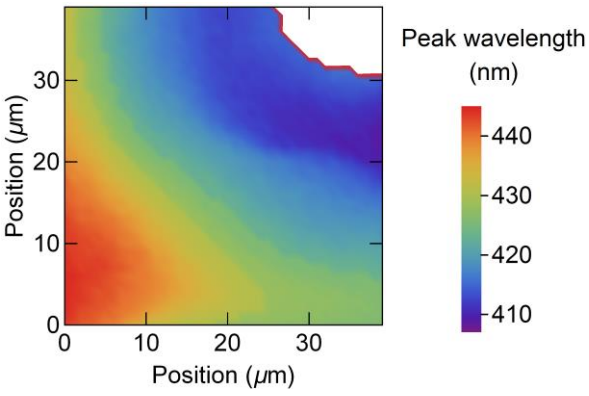


Fig. 1. PL map of the example studied area with variable In content.

[1] Kafar et al., 20a-E310-7, The 80th JSAP Autumn Meeting 2019, Sapporo 18-21.09.2019.

[2] Kafar et al., ThP-CH-6, APWS2019, Okinawa 10-15.11.2019

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