# Effects of modified compressive strain on crystal and optical properties of InGaN/GaN multiple quantum wells grown by MOCVD

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A series of green-emitting InGaN/GaN multiple-quantum wells samples with different In-content InGaN pre-strain layer are grown by MOCVD, and the effect of strain modification on the crystal quality and optical properties is comprehensively investigated. It is found that when a bulk InGaN layer is inserted beneath the InGaN/GaN MQWs, a better crystal quality is obtained, and the V-pits density is reduced to $1.9 \times 10^8$ /cm$^2$ and $3.3 \times 10^8$ /cm$^2$, respectively, while the V-pits density of the original sample is as high as $4.0\times 10^8$ /cm$^2$. And the photoluminescence (PL) wavelength of the sample, which has an In0.03GaN pre-strain layer, is blue-shifted by 6 nm because of the weakened piezoelectric field, while the PL wavelength of another sample, which has an In0.1GaN insertion layer, is redshifted by 15 nm on the contrary. It turns out that the outcome is influenced by multiple factors, such as the 19% degree of strain relaxation of the InGaN/GaN MQWs, the 0.6 nm increase of the InGaN well width due to the composition pulling effect and the 1% increase of the In-content in the InGaN QW. Meanwhile, the samples inserted with InGaN pre-strain layer show twice stronger low-temperature PL (LTPL) intensity than that of the conventional sample, even though the In-content is different, and the corresponding internal quantum efficiency (IQE) is nearly three time larger at the maximum. These significant improvements are primarily attributed to the mitigated Quantum Confined Starks Effect (QCSE) and stronger carrier localization, which is proved by the temperature-dependent PL (TDPL).

## Biography

Tian Lan is pursuing PhD of grade four from Beijing University of Technology. His major is Gallium Nitride based materials and opto-electric devices, such as GaN-based light emitting diode (LED) and laser diode (LD). He has already fabricated 2W GaN-based blue LD on sapphire substrate by using epitaxial lateral overgrowth method (ELOG) successfully.

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