

Accepted Manuscript

Title: Advantages of InGaN/InGaN quantum well light emitting diodes: better electron-hole overlap and stable output

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PII: S0030-4026(17)30490-4

DOI: <http://dx.doi.org/doi:10.1016/j.ijleo.2017.04.086>

Reference: IJLEO 59128

To appear in:

Received date: 28-1-2017

Accepted date: 23-4-2017

Please cite this article as: Anup Gorai, Siddhartha Panda, Dipankar Biswas, Advantages of InGaN/InGaN quantum well light emitting diodes: better electron-hole overlap and stable output, *Optik - International Journal for Light and Electron Optics* <http://dx.doi.org/10.1016/j.ijleo.2017.04.086>

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Advantages of InGaN/InGaN quantum well light emitting diodes: better electron-hole overlap and stable output

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Abstract

Shift of the emission spectrum and the efficiency loss with the operating current are the major challenges in the conventional InGaN/GaN QW LEDs. Several approaches are being tried by different research groups to overcome this hurdle, including, introduction of In in the barriers for which a rigorous study seemed essential. In this paper, our comprehensive and systematic studies on InGaN/InGaN quantum well light emitting diodes reveal that the overlap of electron and hole wave functions can be increased even at low operating currents by the introduction of In in the barriers. The changes of output emission for different In content in the barrier and various doping at different currents are reported, which show that the shift of the energy can be minimized for suitable choice of parameters. The emission and the overlap of electron and hole wave functions have a significant dependence on the doping in the barrier layers which may be used advantageously. Computations have been performed through the self-consistent solutions of Schrödinger and Poisson equations.

Keywords: InGaN; Quantum Well Light Emitting Diodes; Transition energy; Current density.

1 Introduction

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