GaN-based visible and ultra-violet light emitting diodes: An overview of design and fabrication

Suchandan Pal

Opto-electronics and MOEMS Group,
CSIR-Central Electronics Engineering Research Institute (CSIR-CEERI),
Pilani – 333 031 (Rajasthan)
Email: spal@ceeri.res.in

ABSTRACT

GaN-based materials, especially with Aluminum (Al) and Indium (In) compositions, have drawn much attention for last two decades due to their tremendous potential in light-emitting-diode (LED) and laser diode (LD) applications over a wide range of wavelength starting from ultraviolet to visible region. These devices cover a wide range of societal as well as strategic applications in the areas of solid state lighting; these include signaling, sensing, UV-curing, lithography, sterilization including water disinfection and so on. LEDs having quantum-well region of InGaN and AlGaN based materials are responsible for light emission in the regions of visible and ultra-violet wavelength respectively. In general, LEDs have various advantages like compact-size, energy-efficient, environment-friendly, highly reliable and long lifetime over conventional light sources such as incandescent and fluorescent lamps. However, the overall efficiency and the light extraction from the LEDs are always issues and these are more critical in case of ultra-violet emission.

In this paper, an overview of design and fabrication of these devices including the issues of light extraction from visible and UV-LED devices would be discussed and subsequently a few remedies would be addressed. Efforts of CSIR-CEERI towards development of GaN/InGaN visible-LEDs and AlGaN-based UV-LEDs would be presented. Recent trends for achieving better performance of LEDs in terms of efficiency and droop would also be discussed.

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