**Topic** | **Optoelectronics**

# Reduced Thickness Strain-Free GaN/InAlN Short Period Superlattice Bottom Cladding for 450 nm Laser Diodes

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This work presents the theoretical idea of utilizing strain-free GaN/InAlN short period superlattices (SPSL) as the reduced thickness bottom cladding for the InGaN laser diode (LD) emitting at 450 nm. We have replaced 700 nm n-$Al_{0.065}Ga_{0.935}N$ bottom cladding with 100 stacks of n-GaN/ n-$In_{0.18}Al_{0.82}N$ SPSL having thickness of 1 nm each, as shown in Fig 1. The refractive index of $In_{0.18}Al_{0.82}N$ is 2.3603 which is far lower than the conventional $Al_{0.065}Ga_{0.935}N$ cladding ~2.477. Thus, 200 nm SPSL layers are sufficient to achieve the optical field confinement equivalent to the conventional structure. As shown in Fig 2 and 3, the optical field confinement factor in the waveguide of reference LD is 3.28%, with 200 nm SPSL it is 3.43%. However, the strain due to $Al_{0.065}Ga_{0.935}N$ cladding is $-0.9321\times10^{-3}$ which has been eliminated due to the lattice matched GaN/InAlN SPSL. The L-I characteristic of both the laser diodes remains unchanged, however, the slight increase in resistance at higher applied bias has been observed. The computations are carried out in SiLENSe 5.12 tool.

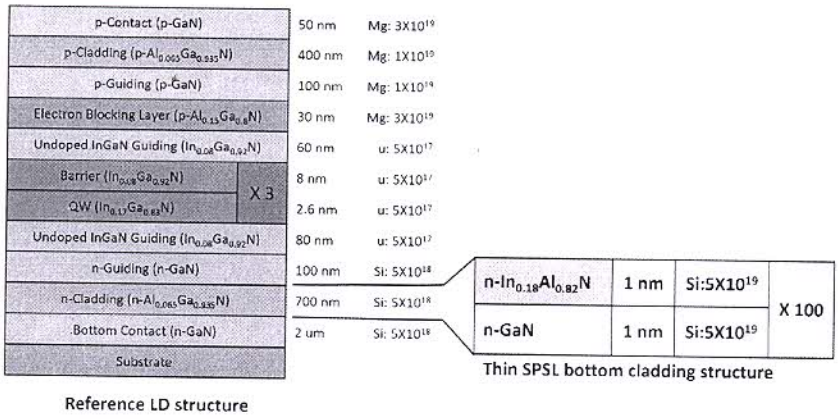


Figure 1 Epitaxial Structure of Reference LD and SPSL cladding

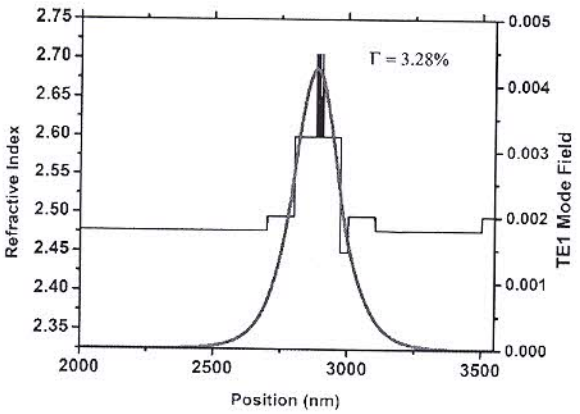


Figure 3 TE1 Mode optical field confinement in reference LD

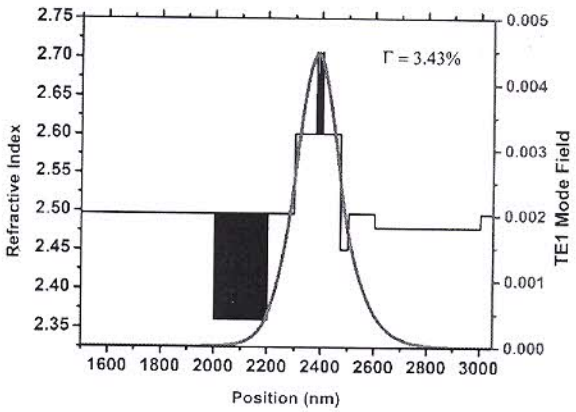


Figure 2 TE1 Mode optical field confinement in SPSL cladding LD