

## **A comparative study of confined carrier concentration of laser using quantum well and quantum dot in active layer**

### **Abstract**

This paper presents a comparative analysis of the characteristics of confined carrier concentration in the gain medium as well as the carrier concentration at the threshold. We have studied extensively these phenomena by using  $\text{In}_x\text{Ga}_{1-x}\text{N}$  based quantum well and  $\text{In}_x\text{Ga}_{1-x}\text{N}$  based quantum dot in the active layer of the laser structure. The numerical results obtained are compared to investigate the superiority of the quantum dot over quantum well. It is ascertained from the comparison results that  $\text{In}_x\text{Ga}_{1-x}\text{N}$  based quantum dot provides higher density of confined carrier and lower level of carrier concentration required for lasing action. This paper reports the enhancement of confined carrier density and minimization of carrier concentration at threshold of laser using  $\text{In}_x\text{Ga}_{1-x}\text{N}$  based quantum dot as the active layer material. Hence, it is revealed that better performances of lasers have been demonstrated using  $\text{In}_x\text{Ga}_{1-x}\text{N}$  based quantum dot than that of quantum well in the active medium of the device structure.

### **Keywords**

Active layer thickness;  $\text{In}_x\text{Ga}_{1-x}\text{N}$ ; Quantum dot; Quantum well