

Effect of band-offset ratio on characteristics of blue InGaN quantum-well lasers

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Abstract

The effect of the band-offset ratio on the characteristics of the blue InGaN quantum-well lasers is studied numerically. Specifically, the optical properties are investigated when the band-off ratio of the $\text{In}_x\text{Ga}_{1-x}\text{N}/\text{In}_y\text{Ga}_{1-y}\text{N}$ heterojunction is $7/3$. Simulation results indicate that the laser performance is better for a blue laser diode with a band-offset ratio of $7/3$ than for one with a band-offset ratio of $3/7$. Moreover, the problem of non-uniform hole distribution in the blue InGaN quantum-well lasers becomes less severe, and the non-uniform electron distribution becomes more obvious when the band-offset ratio is changed from $3/7$ to $7/3$. The lowest threshold current is obtained when the number of InGaN well layers is one when the band-offset ratio is $7/3$.

Keywords: InGaN, Band-Offset Ratio, Quantum-Well Laser, Threshold Current.

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投稿日期：950321 接受刊登日期：950627

導電帶與價電帶井深比例對藍光氮化銦鎵量子井雷射特性之影響

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摘要

本文以數值計算來探討導電帶與價電帶井深比例對藍光氮化銦鎵量子井雷射特性的影響。特別是導電帶與價電帶井深比例為7/3的 $\text{In}_x\text{Ga}_{1-x}\text{N}/\text{In}_y\text{Ga}_{1-y}\text{N}$ 異質結構的光學特性。結果顯示井深比例為7/3的藍光雷射其雷射效能比3/7好。此外，當井深比例從3/7改變為7/3時，在藍光雷射的量子井裡的電洞不均勻分布變得不嚴重，但電子不均勻分布變得明顯。當井深比例為7/3時，單一量子井有最低的臨界電流。

關鍵詞：氮化銦鎵、導電帶與價電帶井深比例、量子井雷射、臨界電流。

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