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器件制备及器件物理

In含量对InGaN/GaN LED光电性能的影响

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摘要： 运用软件模拟和理论计算的方法分析了In含量对发光二极管光电性能的影响,研究了In含量与光谱功率密度、量子阱中载流子的浓度、辐射速率、发光功率等之间的关系。分析结果表明:电子泄漏与能带填充是影响光电性能的主要原因。当In含量较低时,随着电流密度增大(<8 kA/cm^2),光谱发生蓝移程度相对较小,但电流密度太大(>8 kA/cm^2)会造成电子泄漏,发光功率降低;而当In含量较高时,随着电流密度增大,光谱发生蓝移程度相对较大,但在电流密度较大时,会获得较高的发光功率。因此,为了使InGaN/GaN发光二极管获得最大量子效率与发光效率,应该根据电流密度的大小(8 kA/cm^2)来选择In含量的高低。

关键词： In含量 效率下降 数值模拟 InGaN/GaN发光二极管

The Effects of In Content on The LED Photoelectric Performance InGaN/GaN

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Abstract: The photoelectric properties of the light-emitting diodes were analyzed with various In content by software simulation and numerical calculation method. The relationship between In content and power spectral density, carrier concentration of the quantum well, radiative rates, and luminous power were investigated. The results show that the electron leakage and band filling are the main reason for impacting photovoltaic performance. When In content is lower, the spectrua blue shift is relatively small with the current density increasing(<8 kA/cm^2), but the electron leakage will happen when the current density increases to a certain value(>8 kA/cm^2), and the out power will reduce. When In content is higher, the spectrua blue shift is relatively larger with the current density increasing, however, the output power is higher. Accordingly, in order to make the InGaN/GaN light emitting diodes obtain the maximum quantum efficiency and light emitting efficiency, the In content need to be selected according to the value of the current density(8 kA/cm^2).

Keywords: In concentration efficiency droop numerical simulate InGaN/GaN LED
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