

论文

顶端ZnO纳米结构对GaN基LED光提取效率的影响

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摘要:

为了提高GaN基蓝光LED的光提取效率,本文建立了LED顶面分别铺设ZnO纳米柱和纳米锥结构的两种模型,利用时域有限差分法对两种模型进行仿真并对结果进行了比较.仿真结果表明,ZnO纳米结构的各项几何结构参量(包括排列周期 P 、高度 L 、宽度 W 以及斜率 k 等),对LED顶端光提取效率影响显著.仿真分别得到了两种结构的最佳模型,通过比较,LED顶面纳米柱和纳米锥结构对光提取效率的提高效果相近,其最佳提取效率分别增强至无任何结构时的2.5倍和2.3倍.同时,通过对各项参量扫描获得的对光提取效率的变化曲线进行了分析,并给出了相应相应的理论解释.这些模型优化和理论分析对实际的高性能GaN基LED的设计制造有着指导意义.

关键词: 发光二极管 ZnO纳米结构 光提取效率 时域有限差分

Influence of Surface ZnO Nano-structures on the Light Emitting Efficiency of GaN-based LED

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Abstract:

In order to improve the light emitting efficiency(LEE) of GaN-based blue LED, two LED models covered by ZnO nano-structures, including nano-rod and nano-cone structures, are simulated in the method of FDTD. The results of these simulations show that the light emitting efficiency of LED is varying regularly with the different nanostructures' geometric parameters (such as the period: P , the wide of bottom: W , and the length: L). The optimized model structure is obtained, and it is found that both ZnO nano-rod and nano-cone can bring obviously incensement (250% and 230%) on LEE. Besides, with the analysis on the variation curve, the influence of ZnO nano-structure and the reason of the optimization results are theoretically explained. These results provide a theoretical reference on the practical design and optimization of highly efficient GaN-based LED.

Keywords: Light emitting diodes ZnO nanorod structure Light emitting efficiency Finite-difference time-domain

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