

## 论文

### 聚合物电致发光器件工作层热效应的喇曼光谱研究

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#### 摘要:

以喇曼光谱和红外测温仪为表征手段, 研究了聚合物电致发光器件在施加不同电流密度的工作条件下器件内部热效应对器件老化的影响. 通过实验得到器件内发光层的斯托克斯喇曼信号和反斯托克斯喇曼信号强度的比值, 代入波尔兹曼方程计算得到该层对应的温度, 从而达到精确测量器件内部工作温度的目的. 通过对器件施加0~169 mA/cm<sup>2</sup>的电流密度, 发现器件内部工作温度逐渐升高, 最终达到有机层的玻璃化转变温度后, 发光层材料发生相变, 变成游离状的液态, 这种状态不稳定, 造成发光层材料的局部缺陷, 使得器件阴阳极短接导致器件短路, 从而发光失败. 实验表明喇曼光谱是一种探测薄膜器件内部工作层温度的有效手段.

关键词: 喇曼光谱 热致老化 斯托克斯 反斯托克斯 聚合物电致发光器件

### Raman Spectra Study of Thermal Effect of Polymer Light-Emitting Diodes

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#### Abstract:

Raman spectra and infrared imaging systems are used for the study of internal temperatures of polymer light-emitting diodes. The thermal degradations of polymer light-emitting diodes with different current densities are investigated. Raman intensity is proportional to the number of molecules in the next higher vibration energy level, and accurate internal temperature of polymer light-emitting diodes at thermal equilibrium can be calculated with the ratio of anti-stokes to stokes Raman intensity by Boltzmann equation. With the current density of polymer light-emitting diodes going from 0 to 169 mA/cm<sup>2</sup>, it is found that the internal temperature of polymer light-emitting diodes increases accordingly. When the temperature comes to the glass transition temperature of the emission layer, there is a phase change in it and the layer becomes free state as liquid, which is not stable. Local disfigurement in the emission layer results in short circuit between the cathode and the anode of a polymer light-emitting diode, and the luminescence of polymer light-emitting diode fails. Therefore, Raman spectra is considered as a good method for detecting temperature of thin-film semiconductor devices.

Keywords: Raman spectra Thermal aging Stokes Anti-stokes PLEDs

收稿日期 2012-05-28 修回日期 2013-01-15 网络版发布日期

DOI: 10.3788/gzxb20134204.0392

基金项目:

国家自然科学基金委员会与中国民用航空局联合项目(No.61179043)资助

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