

论文

发射层厚度对透射式GaAs光电阴极表面光电压谱的影响

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摘要:

通过求解一维稳态少子扩散方程, 推导了含有后界面复合速率和发射层厚度的透射式GaAs光电阴极表面光电压谱理论方程. 通过对发射层厚度分别为1.6 μm 和2.0 μm , 掺杂浓度为 $1 \times 10^{19} \text{ cm}^{-3}$ 的GaAs透射式阴极样品测试, 理论曲线和实验曲线基本一致. 通过引入表面光电压谱积分灵敏度公式, 仿真探讨了表面光电压谱在一定体材料参量条件下, 积分灵敏度受发射层厚度的影响. 发现在体材料参量一定条件下, 透射式GaAs光电阴极具有最佳厚度, 同时最佳厚度受后界面复合速率的影响更大, 同时GaAlAs窗口层也能很好降低发射层后界面复合速率.

关键词: GaAs光电阴极 表面光电压谱 电子扩散长度 发射层厚度 后界面复合速率

Reflection on Surface Photovoltage Spectroscopy for Transmission-mode GaAs Photocathodes of Different Active Layer Thickness

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Abstract:

Equations for surface photovoltage spectroscopy were deducted, by solving the on-dimensional diffusion equation for equilibrium minority carriers of transmission-mode GaAs photocathode. Through measuring the surface photovoltage curves for GaAs photocathodes with the active layer thickness of 1.6 and 2.0 μm , doping concentration of $1 \times 10^{19} \text{ cm}^{-3}$, experiments and fitting curves fit very well. By leading the formulas for integral sensitivity of surface photovoltage spectroscopy, the inflection of active layer thickness for integral sensitivity was analyzed under certain body parameters through emulations. It was found that GaAs photocathodes have a optimal active layer thickness and the back-interface recombination velocity inflects more on optimal thickness than electron diffusion length. Furthermore, GaAlAs window layer could help to well reduce the back-interface recombination velocity for active layer thickness.

Keywords: GaAs photocathodes Surface photovoltage spectroscopy Electron diffusion length Active layer thickness Back-interface recombination velocity

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