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材料合成及性能

$ZnAl_2O_4$：Tb^{3+}荧光粉的合成、结构及其光学性能研究

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摘要： 通过溶胶-凝胶法制备出不同Tb^{3+}掺杂浓度和不同二次煅烧温度下的$ZnAl_2O_4$:Tb^{3+}荧光粉, 并利用X射线衍射(XRD)和荧光光谱等对样品进行了表征。由XRD结果可知,当Tb^{3+}掺杂的摩尔分数不大于9%,二次煅烧温度在600℃以上时,所得粉体为结晶性良好的尖晶石相。在紫外光激发下,$ZnAl_2O_4$:Tb^{3+}荧光粉的发射光谱由位于488 nm($^5D_4\rightarrow{}^7F_6$)、542 nm($^5D_4\rightarrow{}^7F_5$)、587 nm($^5D_4\rightarrow{}^7F_4$)和621.5 nm($^5D_4\rightarrow{}^7F_3$)的4个发射峰组成。研究发现,Tb^{3+}的掺杂浓度和二次煅烧温度对样品发光强度有着重要影响,当Tb^{3+}的摩尔分数为5%,二次煅烧温度为900℃时,$ZnAl_2O_4$:Tb^{3+}荧光粉的发光最强,继续增加Tb^{3+}掺杂浓度或提高煅烧温度,分别会出现浓度猝灭和温度猝灭现象。

关键词： $ZnAl_2O_4$ Tb^{3+} 荧光粉 结构 光致发光

Synthesis, Structure and Optical Property of $ZnAl_2O_4$：Tb^{3+} Phosphor

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Abstract: The $ZnAl_2O_4$:Tb^{3+} phosphor powders were synthesized by sol-gel method with different doping concentrations of Tb^{3+} and secondary calcination temperatures. Then they were characterized by X-ray diffraction (XRD) and photoluminescence (PL). The XRD patterns show that the pure spinel phase of high crystallinity can be obtained when the mole fraction of Tb^{3+} is less than 9% and the secondary calcination temperature exceeds 600℃. Under the excitation of ultraviolet light, the emission spectra of $ZnAl_2O_4$:Tb^{3+} phosphor consists of four peaks locating at 488 nm ($^5D_4\rightarrow{}^7F_6$), 542 nm ($^5D_4\rightarrow{}^7F_5$), 587 nm ($^5D_4\rightarrow{}^7F_4$), and 621.5 nm ($^5D_4\rightarrow{}^7F_3$). The influence of Tb^{3+} concentration and secondary calcination temperature on the luminescence intensity was significant. The photoluminescence spectra intensity of $ZnAl_2O_4$:Tb^{3+} is the strongest when the mole fraction of Tb^{3+} is 5% and the secondary calcination temperature is 900℃. When the mole fraction of Tb^{3+} and the secondary calcination temperature increase excessively, concentration quenching and temperature quenching appear, respectively.

Keywords: $ZnAl_2O_4$ Tb^{3+} phosphor structure photoluminescence
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