



材料合成及性能

白光LED用红色荧光粉 $\text{Sr}_2\text{Eu}_x\text{Gd}_{1-x}\text{AlO}_5$ 的制备及其发光性质孙晓园¹, 贺小光¹, 于立军¹, 高允锋¹, 郭锦泉¹, 骆永石², 张家骅², 吴春雷³

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摘要：用高温固相反应法合成了 $\text{Sr}_2\text{Eu}_x\text{Gd}_{1-x}\text{AlO}_5$ 红色荧光粉,研究了荧光粉的晶体结构和发光性质。在紫外光和近紫外光激发下,样品的发射光谱由 Eu^{3+} 的 ${}^5\text{D}_0 \rightarrow {}^7\text{F}_J (J=0, 1, 2, 3, 4)$ 特征发射组成,其中 Eu^{3+} 离子的 ${}^5\text{D}_0 \rightarrow {}^7\text{F}_1 (\lambda=590 \text{ nm})$ 和 ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2 (\lambda=622 \text{ nm})$ 跃迁发射的强度最大。当 Eu^{3+} 离子的摩尔分数为 0.75时,样品的发光最强。研究表明, $\text{Sr}_2\text{Eu}_x\text{Gd}_{1-x}\text{AlO}_5$ 荧光粉是一种在近紫外芯片白光LED上有应用前景的红光荧光粉。

关键词：荧光粉 光致发光 白光LED

Preparation and Photoluminescence Properties of Red Emitting $\text{Sr}_2\text{Eu}_x\text{Gd}_{1-x}\text{AlO}_5$ Phosphor for White LEDSUN Xiao-yuan¹, HE Xiao-guang¹, YU Li-jun¹, GAO Yun-feng¹, GUO Jin-quan¹, LUO Yong-shi², ZHANG Jia-hua², WU Chun-lei³

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Abstract: The red emitting phosphor $\text{Sr}_2\text{Eu}_x\text{Gd}_{1-x}\text{AlO}_5$ was synthesized through the solid-state reaction technique. The structure, photoluminescence properties of $\text{Sr}_2\text{Eu}_x\text{Gd}_{1-x}\text{AlO}_5$ were described. Under the excitation of UV and near UV light, the photoluminescence emission spectra can be assigned to the well-known transitions of Eu^{3+} from the initial state ${}^5\text{D}_0$ to the final states ${}^7\text{F}_J (J=0, 1, 2, 2, 4)$. The two strong emissions peak at 590 nm and 622 nm, which arose from the ${}^5\text{D}_0 \rightarrow {}^7\text{F}_1$ and ${}^5\text{D}_0 \rightarrow {}^7\text{F}_2$ transitions of Eu^{3+} , respectively. When the mole fraction of Eu^{3+} is 0.75, the emission intensity of the phosphor is the strongest. This phosphor is considered to be a potential red-emitting phosphor for NUV chip white LED.

Keywords: phosphor photoluminescence white light emitting diode

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参考文献:

- [1] Kuo C H, Sheu J K, Chang S J, *et al.* n-UV+blue/green/red white light emitting diode lamps [J]. *Jpn. J. Appl. Phys.*, Part .2003, 42:2284-2287 [crossref](#)
- [2] Xie R J, Hirosak N, Mitomo M, *et al.* Wavelength-tunable and thermally stable Li- α -sialon:Eu²⁺ oxynitride phosphors for white light-emitting diodes [J]. *Appl. Phys. Lett.*, 2006, 89(24):241103-1-3.
- [3] Wang L, Zhang X, Hao Z D, *et al.* Energy transfer in $\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}^{3+}$, Cr^{3+} and $\text{Y}_3\text{Al}_5\text{O}_{12}:\text{Ce}^{3+}$, Pr^{3+} , Cr^{3+} phosphors [J]. *Chin. J. Lumin.*(发光学报), 2011, 32(5):418-422 (in Chinese).
- [4] Kim J S, Jeon P E, Choi J C, *et al.* Warm-white-light emitting diode utilizing a single-phase full-color $\text{Ba}_3\text{MgSi}_2\text{O}_8:\text{Eu}^{2+}$, Mn^{2+} phosphor [J]. *Appl. Phys. Lett.*, 2004, 84(15):2931-2933.
- [5] Zhang Y Y, Xia Z G, Wu W W. Luminescence properties and energy transfer of $\text{Sr}_3\text{Gd}_{0.5-x}\text{Tb}_{0.5}(\text{BO}_3)_3:\text{xEu}^{3+}$ [J]. *Chin. J. Lumin.*(发光学报), 2012, 33(9):949-953 [crossref](#)
- [6] Sun X Y, Hao Z D, Li C J, *et al.* Enhanced orange-red emission by using Mo codoped in $\text{Ba}_2\text{CaWO}_6:\text{Eu}^{3+}$, Li^+ phosphor under near UV excitation [J]. *J. Lumin.*, 2013, 134(1):191-194.
- [7] Wang R, Xu J, Chen C. Fabrication and luminescence properties of $\text{Sr}_3\text{B}_2\text{O}_6:\text{Eu}^{3+}$, Na^+ phosphor for white LED applications [J]. *Chin. J. Lumin.*(发光学报), 2011, 32(10):983-987 [crossref](#)
- [8] Drogenik M, Golic L. R++refinement of the $\text{Sr}_2\text{EuFeO}_5$ and SrEuAlO_5 structures [J]. *Acta Cryst.*, 1979,

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[9] Zhang S Y. *Spectroscopy of Rare Earth Ions* [M]. Beijing: Science Press, 2008:251.

[10] Hong G Y. *Luminescent Materials of Rare Earth* [M]. Beijing: Science Press, 2011:98-99.

[11] Sun J Y, Du H Y, Hu W X. *Solid Luminescent Materials* [M]. Beijing: Chemical Industry Press, 2003:91-92.