

激光技术与器件

Ca₃(PO₄)₂:RE₃₊ (RE=Eu,Dy,Ce,Tb) 荧光粉的制备及其发光特性

孟涛, 胡正发, 张伟, 王雄庭, 叶定华, 王银海, 罗莉, 王伟, 杜姬芳

1 广东工业大学物理与光电工程学院, 广东 广州 510006; 2 中山市鸿宝电业有限公司, 广东 中山 518476

摘要: 采用高温固相法合成了Ca₃(PO₄)₂:RE₃₊(RE = Eu, Dy, Ce, Tb)系列发光材料, 研究了其发光性质。研究表明Ca₃(PO₄)₂: RE₃₊ 在紫外区域均能有效被激发, 有很强的荧光发射, 且发光范围覆盖蓝到红光波段, 是一类可以紫外激发实现白光LED用的潜在荧光粉。在0.005到0.03 mol 浓度范围内, Eu, Dy和Ce掺杂的荧光粉的发光都发生了浓度淬灭, 分别对应于0.025, 0.025和0.02 mol, 而Tb₃₊掺杂的样品的表现出高的发光淬灭浓度。

关键词: 材料 荧光粉 高温固相法 磷酸盐基质 白光LED

Preparation and luminescence properties of Ca₃(PO₄)₂: Re₃₊ (Re=Eu,Dy,Ce,Tb) phosphors

MENG Tao, HU Zheng-fa, ZHANG Wei, WANG Xiong-ting, YE Ding-hua, WANG Yin-hai, LUO Li, WANG Wei, DU Ji-Fang

1 College of Physics & Optoelectronic Engineering, Guangdong University of Technology, Guangzhou 510006, China; 2 Zhongshan Hongbao Electrical Co. Ltd., Zhongshan 518476, China

Abstract: A series of phosphors Ca₃(1-x)(PO₄)₂: xRE₃₊(RE = Eu, Dy, Ce, Tb) have been prepared by a high temperature solid-state reaction method. Their luminescence properties were investigated. The results indicated that all samples could be effectively excited by ultraviolet light with the range from blue to red light, and they are the potential phosphors to obtain white LED excited by ultraviolet light. In the range of 0.005 to 0.03 mol, photoluminescence quenching concentration of Eu³⁺, Dy³⁺, and Ce³⁺-doped are 0.025, 0.025, and 0.02 mol, respectively, and Tb³⁺-doped samples has high quenching concentration.

Keywords: materials phosphor high temperature solid-state reaction phosphate substrate white LED

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通讯作者: 胡正发 (1972-), 博士, 从事激光光谱应用和发光材料研究.

作者简介: 孟涛 (1988-) 江西人, 研究生, 从事单一基质白光LED用荧光粉制备和发光特性研究.

作者Email: zhfh@gdut.edu.cn

参考文献:

[1] Nakamura S. Present performance of InGaN-based blue/green/yellow LEDs [J]. Proc. SPIE-Int. Soc. Opt. Eng., 1997, 3002: 26-35.

[2] Wu Z C, Shi J X, Wang J, Gong M L, Su Q. A novel blue-emitting phosphor LiSrPO₄:Eu²⁺ for white LEDs [J]. J. Solid State Chem., 2006, 179(8): 2356-2360.

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- [3] Yang Zhiping, Yang Guangwei, Wang Shaoli, Tian Jing, Li Xiaoning, Guo Qinglin, Fu Guangsheng. A novel green-emitting phosphor NaCaPO₄:Eu²⁺ for white LEDs [J]. Mater. Lett., 2008, 62(12-13): 1884-1886.
- [4] Huang Yanlin, Kai Weifang, Jang Kiwan, Lee H S, Wang Xigang, Zhang Ying, Qin Dake, Jiang Chanfang. The luminescence properties of Sm²⁺ doped sodium barium strontium phosphate [J]. Mater. Lett., 2008, 62(12-13): 1913-1915.
- [5] Li Pailai, Wang Zhijun, Yang Zhiping, Guo Qinglin. Sr₂B₂P₂O₁₀: Eu²⁺, Mn²⁺, Ba²⁺: A Potential Single-Phase White Light-Emitting Phosphor for UV Light Emitting Diodes [J]. J. Electrochem. Soc., 2010, 157(5): H504-H509.
- [6] Sakuma K, Omichi K J, Kimura N, Ohashi M, et al. Warm-white light-emitting diode with yellowish orange SiAlON ceramic phosphor [J]. Optics. Lett., 2004, 17(29): 2001-2003.
- [7] Rossner W, Grabmainer B C. Phosphors for X-ray detectors in computed tomography [J]. J. Lumin., 1991, 48&49: 29-36.
- [8] Miejerink A, Blasse G. Photostimulated luminescence and thermally stimulated luminescence of some new X-ray storage phosphors [J]. J. Phys. D: Appl. Phys., 1991, 24(4): 626-632.
- [9] Wang Jing, Zhang Zhiyang, Zhang Mei, Zhang Qihong, Su Qiang, Tang Jinke. The energy transfer from Eu²⁺ to Tb³⁺ in Ca₁₀K(PO₄)₇ and its application in green light emitting diode [J]. J. Alloys Compd., 2009, 488(2): 582-585.
- [10] Huang Yanlin, Ding Haiyan, Jang Kiwan, Cho E J, Lee H S et al. Luminescence properties of triple phosphate Ca₈MgGd(PO₄)₇: Eu²⁺ for white light-emitting diodes [J]. J. Phys. D: Appl. Phys., 2008, 41(9): 095110.
- [11] Wu Zhanchao, Liu Jie, Gong Menglian. Thermally stable luminescence of SrMg₂(PO₄)₂: Eu²⁺ phosphor for white light NUV light-emitting diodes [J]. Chem. Phys. Lett., 2008, 466(1-3): 88-90.
- [12] Yang Woanjen, Chen Tengming. White-light generation and energy transfer in SrZn₂(PO₄)₂: Eu, Mn phosphor for ultraviolet light-emitting diodes [J]. Appl. Phys. Lett., 2006, 88: 101903(3).
- [13] Nagpure I M, Saha S, Dhoble S J. Photoluminescence and thermoluminescence characterization of Eu³⁺- and Dy³⁺- activated Ca₃(PO₄)₂ phosphor [J]. J. Lumin., 2009, 129: 898-905.
- [14] Huang Yanlin, Wang Xigang, Xiao Guoxian. Existence of Interstitial Oxygen in Rare-earth Ions-doped PbWO₄ Single Crystal [J]. J. Synthetic Crystals (人工晶体学报), 2007, 36(6): 1324-1329 (in Chinese).
- [15] Xu Xurong, Su Mianzeng. Luminescence and Luminescent Materials (发光学与发光材料). Beijing: Chemical Industry Press, 2004, 49-58 (in Chinese).
- [16] Yu M, Lin J, Wang Z, Fu J, Wang S, Zhang H J, Han Y C. Fabrication, Patterning, and Optical Properties of Nanocrystalline YVO₄: A (A = Eu³⁺, Dy³⁺, Sm³⁺, Er³⁺) Phosphor Films via Sol-Gel Soft Lithography [J]. Chem. Mater., 2002, 14(5): 2224-2231.
- [17] Kuang Jinyong, Liu Yingliang, Zhang Jianxian. White-light-emitting long-lasting phosphorescence in Dy³⁺-doped SrSiO₃ [J]. J. Solid State Chem., 2006, 179(1): 266-269.
- [18] Dou Xihua, Zhao Weirwn, Song Enhai, Min Huachu. Optical Properties and Energy Transfer of Sr_{1-x}-yMgP₂O₇: xCe³⁺, yTb³⁺ Phosphor under Ultraviolet Excitation [J]. Acta Phys.-Chim. Sin. (物理化学学报), 2012, 28(3): 699-705 (in Chinese).
- [19] Tan Yiwei, Shi Chunshan. Optical Spectroscopy Properties and Charge Compensation of BaLiF₃ Doped with Ce³⁺ [J]. J. Solid State Chem., 2000, 150(1): 178-182.
- [20] Suriyamurthy N, Panigrahi B S. Luminescence of BaAl₂O₄: Mn²⁺, Ce³⁺ phosphor [J]. J. Lumin., 2007, 127(2): 483-488.
- [21] Nagpure I M, Shinde K N, Kumar V, Ntwaeaborwa O M, Dhoble S J, Swart H C. Combustion synthesis and luminescence investigation of Na₃Al₂(PO₄)₃: RE (RE = Ce³⁺, Eu³⁺ and Mn²⁺) phosphor [J]. J. Alloys Compd., 2010, 492(1-2): 384-388.
- [22] Shinde K N, Dhoble S J, Kumars A. Combustion synthesis of Ce³⁺, Eu³⁺ and Dy³⁺ activated NaCaPO₄ phosphors [J]. J. Rare Earths, 2011, 29(6): 527-535.

本刊中的类似文章

1. 任坤 冯志芳 任晓斌. 可调谐光子带隙晶体的研究进展[J]. 量子电子学报, 2008, 25(6): 649-656
2. 吉选芒 姜其畅 刘劲松. 外加电场双光子光伏光折变晶体中的空间孤子[J]. 量子电子学报, 2009, 26(6): 722-727
3. 李冬青 丁丽华 张庆礼 邵淑芳 宁凯杰 殷绍唐. 尿素共沉淀法制备Nd:YAG纳米粉体[J]. 量子电子学报, 2010, 27(1): 110-115
4. 谢学武 廖源 张五堂 余庆选 傅竹西. 退火过程对c轴择优取向的ZnO薄膜的光学性质的影响[J]. 量子电子学报, 2010, 27(2): 221-226
5. 谢学武 廖源 张五堂 余庆选 傅竹西. 退火过程对c轴择优取向的ZnO薄膜的光学性质的影响[J]. 量子电子学报, 2010, 27(2): 221-226
6. 吴海信 黄飞 倪友保 王振友 陈林 程干超. 中远红外非线性晶体材料CdSe生长及光学性能研究[J]. 量子电子学报, 2010, 27(6): 711-715
7. 郑勇林 赵茂娟 杨敏. 颗粒膜电介质光子晶体低频折射率问题分析[J]. 量子电子学报, 2010, 27(6): 705-710
8. 曾贵平 姚李 董强 邓赞红 鲍巍涛. 新型白光LED荧光粉Y₂O₃:Ti³⁺的光谱性能[J]. 量子电子学报, 2010, 27(6): 655-660

9. 张霞 焦宝祥 孙芳芳.ZnO基荧光粉的制备及荧光光谱分析[J]. 量子电子学报, 2010,27(6): 661-664
 10. 邓柳咏 胡义华 王银海 吴浩怡 谢伟.SrAl₂O₄ : Eu²⁺和SrAl₂O₄ : Eu²⁺, Dy³⁺+长余辉和热释光谱[J]. 量子电子学报, 2010,27(3): 257-263
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 14. 胡智向 吴玉喜 顾书林 李腾 渠立成.外压调制下ZnO晶体结构与光学性质变化特性的研究[J]. 量子电子学报, 2010,27(5): 613-619
 15. 曾贵平,姚李,董强,鲍巍涛.纳米粉体Y₂O₃:Ti³⁺, Eu³⁺的光谱性能[J]. 量子电子学报, 2011,28(2): 147-151
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