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A novel red-emitting Eu^{3+} -doped $\text{Na}_2\text{MgSiO}_4$ phosphor with high intensity of $^5\text{D}_0 \rightarrow ^7\text{F}_4$ transition

Huidong Tang^{a,*}, Rong Yang^a, Yanlin Huang^b

^a*Department of Chemistry and Materials Engineering, Changzhou Vocational Institute of Engineering, Changzhou, 213164, PR China*

^b*College of Chemistry, Chemical Engineering and Materials Science, Soochow University, Suzhou, 215123, PR China*

ABSTRACT

Novel red-emitting $\text{Na}_2\text{MgSiO}_4: \text{Eu}^{3+}$ phosphors with different Eu^{3+} contents were synthesized by sol-gel method. The crystal structure was confirmed by X-ray powder diffraction. The luminescence properties and decay curves were investigated. The optical Eu^{3+} doping concentration of $\text{Na}_2\text{MgSiO}_4: \text{Eu}^{3+}$ is about 5 mol%. The excitation spectrum exhibits a broad band of 250-500 nm. The abnormal dominant emission peak of $\text{Na}_2\text{MgSiO}_4: \text{Eu}^{3+}$ phosphors excited effectively by 393.5 nm (near-UV) is located at 702 nm due to the $^5\text{D}_0 \rightarrow ^7\text{F}_4$ transition that caused by the highly polarizable chemical circumstance. The CIE chromaticity coordinate and the photoluminescence quantum yield of the $\text{Na}_2\text{MgSiO}_4: 0.05\text{Eu}^{3+}$ phosphor are (0.644, 0.355) and 65.81%, respectively. The mechanism of concentration quenching can be attributed to the dipole-dipole interaction between Eu^{3+} ions and the thermal quenching might be ascribed to the competition between energy transfer and crossover process.

Keywords: Silicates; phosphors; luminescence; rare earths

1. Introduction

* Corresponding author.

E-mail address: hdtang@czie.edu.cn (H.D. Tang).

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