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# Luminescence Properties of $\text{Y}^{3+}$ Stabilized $\text{Gd}_3\text{Al}_5\text{O}_{12}:\text{Tb}^{3+}/\text{Ce}^{3+}$ Phosphors with Yellow Light-Emitting for Warm White LEDs

Wenzhi Wang<sup>1</sup>, Jinkai Li<sup>\*1</sup>, Xin Teng, Qi Chen

School of Materials Science and Engineering, University of Jinan, Jinan, Shandong 250022, China

\*Corresponding author. Dr. Jinkai Li. University of Jinan, Jinan, China. Tel: +86-531-82765894.

E-mail: mse\_lijk@ujn.edu.cn

## Abstract

The new system of  $[(\text{Gd}_{0.9}\text{Y}_{0.1})_{0.9-x}\text{Tb}_{0.1}\text{Ce}_x]\text{AG}$  phosphors have been successfully obtained by using a modified co-precipitation method which include the precursor synthesis and post treatment at 1300 °C. The crystal structure stabilization, morphology, PL/PLE spectra, fluorescence decay analysis and thermal property have been studied in detail. The metastable  $\text{GdAG}:\text{Tb}^{3+}/\text{Ce}^{3+}$  samples could be effectively stabilized via smaller 10 at.%  $\text{Y}^{3+}$  doping, which can develop a new phosphor of  $[(\text{Gd}_{0.9}\text{Y}_{0.1})_{0.9-x}\text{Tb}_{0.1}\text{Ce}_x]\text{AG}$  for exploring the field of the opto-functionality. The presence of  $\text{Gd}^{3+}$  and  $\text{Tb}^{3+}$  excitation bands in the PLE spectra monitoring the  $\text{Ce}^{3+}$  yellow emission directly provides an evidence of  $\text{Gd}^{3+} \rightarrow \text{Ce}^{3+}$  and  $\text{Tb}^{3+} \rightarrow \text{Ce}^{3+}$  energy transfer. The  $[(\text{Gd}_{0.9}\text{Y}_{0.1})_{0.9-x}\text{Tb}_{0.1}\text{Ce}_x]\text{AG}$  phosphors with good dispersion show various luminescence properties monitoring at 275 nm, 331 nm and 452 nm excitation, respectively. The optimized  $(\text{Gd}_{0.9}\text{Y}_{0.1})_{0.89}\text{Tb}_{0.1}\text{Ce}_{0.01}\text{AG}$  phosphor has a red-shifted emission and the applicable emission intensity because of the energy transfer of  $\text{Gd}^{3+} \rightarrow \text{Ce}^{3+}$  and  $\text{Tb}^{3+} \rightarrow \text{Ce}^{3+}$ , thus being more suitable for the application of warm-white lighting than  $\text{YAG}:\text{Tb}^{3+}/\text{Ce}^{3+}$  and  $\text{LuAG}:\text{Tb}^{3+}/\text{Ce}^{3+}$ . The Stokes shift

<sup>1</sup> The two authors contributed equally to this paper.

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