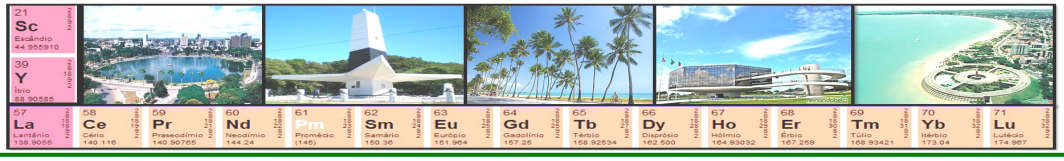
TR-2012

João Pessoa - onde o sol nasce primeiro



Low Temperature Synthesis of $R_2O_3:Eu^{3+}$ (R: Y, Gd and Lu) Nanophosphors Using Tricarboxylate Precursors

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Palavras chave: Luminescence; Europium; Nanomaterial

INTRODUCTION

With improvements made lately in the nanoscience and nanotechnology, the photonic, structural and morphological properties of the R_2O_3 doped with Eu^{3+} nanomaterials (R: Y, Gd and Lu) have been widely investigated.[1] These phosphors have been prepared with various methods, *e.g.* hydrothermal, sol-gel, spray pyrolysis, combustion, chemical vapor deposition, thermolysis and coprecipitation. In the thermolysis route, it is of great advantage to use the RTMA complexes as precursors (TMA: 1,3,5-benzenetricarboxylate) to produce the cubic R_2O_3 materials. The one-step ligand decomposition occurs at low temperature (*ca.* 480 °C), producing the sesquioxides around 500 °C.[2] In this work, the preparation, characterization and luminescence properties of $R_2O_3:Eu^{3+}$ nanomaterials are reported.

RESULTS AND DISCUSSION

The thermogravimetric curves of the $R_{1-x}Eu_xTMA$ complexes (R: Y, Gd and Lu; x = 0.001, 0.005, 0.01 and 0.05) were recorded between 30 and 900 °C. The organic moiety of these complexes decomposes in a single-step from 450 to 570 °C, allowing the formation of R_2O_3 with 1 h annealing at 500 °C. The decomposition temperature decreases for all complexes with increasing Eu^{3+} concentration.

$R_2O_3:Eu^{3+}$ were obtained by annealing the complexes at 500, 600, 700, 800, 900 and 1000 °C for 1 h. The X-ray powder diffraction patterns confirmed the formation of the cubic R_2O_3 phase, indicating the total decomposition of the organic phase during annealing. The crystallinity of the oxides increased with increasing annealing temperature. Calculated with the Scherrer's equation, the crystallites grow from 5 to 115 nm (Fig. 1) between 500 and 1000 °C.

The luminescent properties were investigated by the excitation and emission spectra as well as lifetime measurements of the $^5D_0$ emitting level of Eu^{3+}. The number of lines for the $^5D_0 \rightarrow {}^7F_1$ transition indicates the presence of Eu^{3+} in two sites (C_2 and S_6). The intense hypersensitive $^5D_0 \rightarrow {}^7F_2$ transition due to the non-centrosymmetric C_2 site was observed, too. The quantum efficiency of the $R_2O_3:Eu^{3+}$ phosphors ranges between 50 and 98 %.

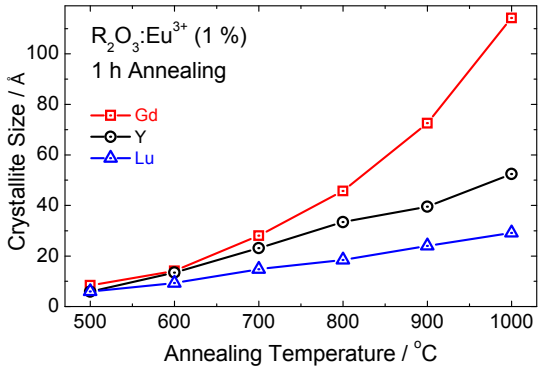

Fig. 1. The correlation between the crystallite size and annealing temperature of $R_2O_3:Eu^{3+}$.

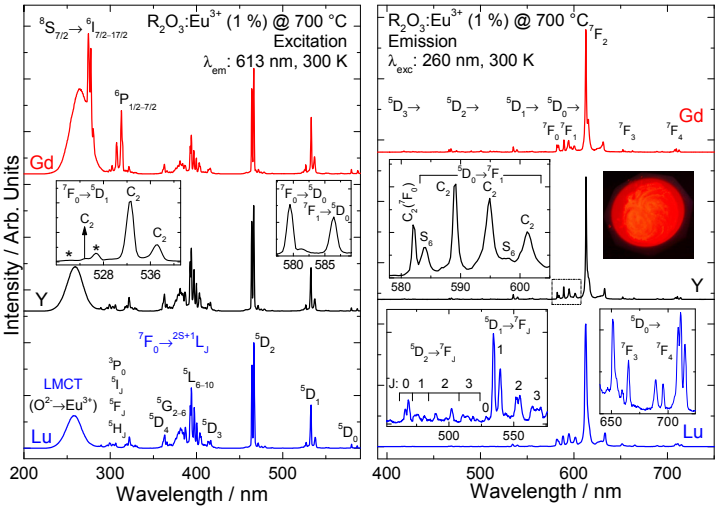

Fig. 2. Excitation and emission spectra of $R_2O_3:Eu^{3+}$.

CONCLUSION

The RTMA complexes proved to be suitable precursors for the preparation of the Eu^{3+} doped R_2O_3 nanophosphors at low temperature, yielding strong luminescence.

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