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Influence of the Calcination Temperature On The Synthesis $\text{RE}_2\text{O}_3:\text{Eu}^{3+}$ Complexes Using Trimellitic Acid

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Rare Earth (RE) complexes with 1,2,4-benzenetricarboxylic acid (trimellitic acid – TLA) present favourable thermal proprieties to prepare nanostructured oxides at low temperatures. The complexes $[\text{RE}_2\text{O}_3:\text{Eu}^{3+} (x \text{ mole-}\%)]$ (x : 0.1, 0.5 and 1.0 %; RE^{3+} : Y, Gd and Lu) were synthesized from 500 to 1000 °C^{1,2}.

The TG analysis of $[\text{RE}(\text{TLA})\cdot(\text{H}_2\text{O})_n:\text{Eu}^{3+}]$ (RE^{3+} : Gd, Y and Lu; n : 4 for Y and Gd and 3 for Lu systems) materials present water molecules mass-loss event in the temperature range from 50 to 330 °C, the organic moiety decomposition complexes show only one single-step decomposition between 450 and 570 °C. In the FTIR the materials present a low intensity oxycarbonate band that reach smaller intensities at higher annealing temperatures, especially for the $\text{Gd}_2\text{O}_3:\text{Eu}^{3+}$ and $\text{Lu}_2\text{O}_3:\text{Eu}^{3+}$ systems¹.

The XPD patterns confirm the formation of the cubic RE_2O_3 phase with total decomposition of the organic phase during annealing. Both the crystallinity and the crystallite sizes of the phosphors increased with increasing annealing temperature between 500 and 1000 °C from 10 to 235 Å. Both complexes and the phosphors are isomorphous for the same RE^{3+} matrix, independently of the Eu^{3+} concentration. The rise of the doping concentration decreases the temperature of decomposition of the materials.

The excitation e emission spectra of the systems present the characteristic emission of the Eu^{3+} ion, the $\text{RE}_2\text{O}_3:\text{Eu}^{3+}$ nanomaterials present quantum efficiency up to ~ 95%.

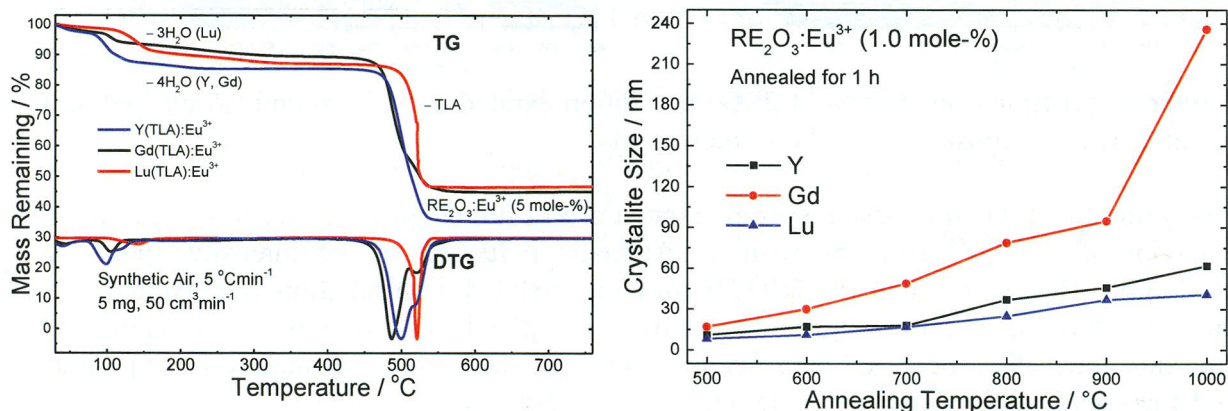


Figure: TG/DTG curves of $[\text{RE}(\text{TLA}):\text{Eu}^{3+}]$ (1.0 mole-%), left; Crystallite size of $\text{RE}_2\text{O}_3:\text{Eu}^{3+}$ (1.0 mole-%) with different annealing temperatures, right.

- (1) Silva, I. G. N.; Rodrigues, L. C. V.; Souza, E. R.; Kai, J.; Felinto, M. C. F. C.; Hölsä, J.; Brito, H. F.; Malta, O. L. *Opt. Mater. (Amst)*. **2015**, *40*, 41–48.
- (2) Rezende Souza, E.; Silva, I. G. .; Teotonio, E. E. S.; Felinto, M. C. F. C.; Brito, H. F. *J. Lumin.* **2010**, *130* (2), 283–291.