Influence of pH and europium concentration on the luminescent and morphological properties of Y2O3 powders

Tzipatly Esquivel-Castro, Felipe de J. Carrillo-Romo, Jorge Oliva-Uc, Antonieta García-Murillo, Gustavo A. Hirata-Flores, Nicolás Cayetano-Castro, Elder De la Rosa, Angel de J. Morales-Ramírez

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Abstract.

This work reports on the synthesis and characterization of Y2O3:Eu3+ powders obtained by the hydrothermal method. We studied the influence of different pH values (7–12) and Eu3+ concentrations (2.5–25 mol%) on the structural, morphological and luminescent characteristics of Y2O3:Eu3+ powders. The hydrothermal synthesis was performed at 200 °C for 12 h by employing Y2O3, HNO3, H2O and Eu (NO3)3 as precursors, in order to obtain two sets of samples. The first set of powders was obtained with different pH values and named Eu5PHx (x = 7, 8, 9, 10, 11, and 12), and the second set was obtained by using a constant pH = 7 with different Eu concentrations, named EuxPH7 (x = 2.5, 5, 8, 15, 20 and 25). The XRD spectra showed that the Y2O3:Eu3+ powders exhibited a cubic phase, regardless of the pH values and Eu3+ concentrations. The SEM observations indicated that pH influenced the morphology and size of phosphors; for instance, for pH = 7, hexagonal microplatelets were obtained, and microrods at pH values from 8 to 12. Doping Y2O3 with various Eu3+ concentrations (in mol%) also produced changes in morphology, in these cases, hexagonal microplatelets were obtained in the range of 2.5–5 mol%, and non uniform plates were observed at higher doping concentrations ranging from 8 to 25 mol%. According to our results, the microplatelets synthesized with a pH of 7 and an 8 mol% Eu3+ concentration presented the highest luminescence under excitation at 254 nm. All of these results indicate that our phosphors could be useful for applications of controlled drug delivery, photocatalysis and biolabeling.

Graphical abstract

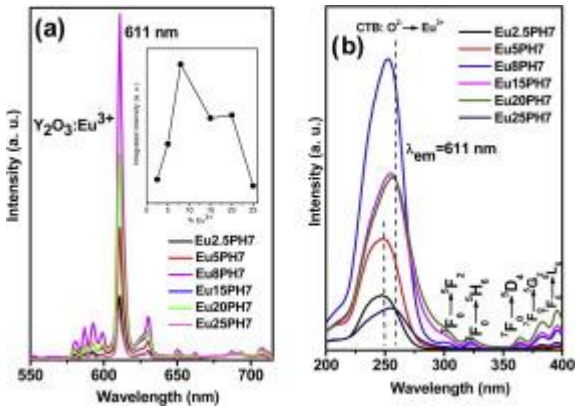

Figure options