

Influence of synthesis parameters on the luminescent properties of KGd₂F₇ fluoride matrix doped with Eu³⁺ ions

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Highlights

This work investigates the influence that synthesis parameters have on the KGd₂F₇ matrix doped with Eu³⁺ ions. Our XRD analysis demonstrated the influence of the time between synthesis and washing of the particles on their size, showing how the synthesis parameters can influence the morphology of the particles, and, consequently, their optical properties.

Abstract

Rare earth fluorides have been recently well studied for their useful characteristics [1], such as their unique optical properties that arise from the electronic structure of the rare earth ions, thermostability, biocompatibility, and color tunability, including materials that present upconverting luminescence [1]. However, in order to refine and perfect all those properties, the synthesis of the materials must be well-studied and understood. With that in mind, this work aims to study the synthesis of rare earth fluorides, with emphasis on the KRE₂F₇ matrix (RE: Eu³⁺, Gd³⁺), through the modified coprecipitation method [2]. This method involves the mixture of rare earth acetates with sources of potassium (KOH) and fluoride (KF) where the solvent consists of a mixture of octadecene, oleic acid, and oleylamine. This mixture is then heated up to 120°C to yield the rare earth oleates. With the formed oleate complexes, the temperature is then raised to 300°C to start the formation of the particles, which are then separated through centrifugation and washed with ethanol and cyclohexane solvents. The prepared materials were characterised by different techniques, such as XRD, SEM, and TEM. Their photoluminescent properties were investigated from the excitation and emission spectra. To understand the synthesis, various parameters, such as temperature, solvents, and preparation time were varied. Our preliminary results show that the particle size increases with the time that it takes for the particles to be washed and that no difference was noted by both increasing and decreasing the cooling times after the step at 300°C.

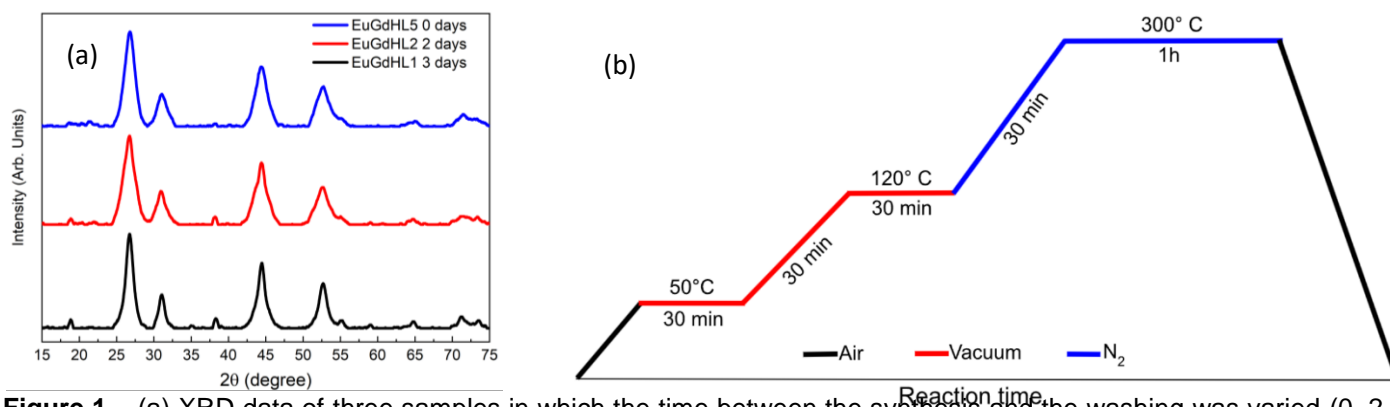


Figure 1 – (a) XRD data of three samples in which the time between the synthesis and the washing was varied (0, 2 and 3 days). (b) Scheme of the synthesis, with the temperatures and duration of each ramp and plateau.

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