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EFFECTS OF EUROPIUM CONTENT ON STRUCTURAL, AND LUMINESCENCE, CHEMICAL PROPERTIES OF YPO₄ POWDERS OBTAIN BY HYDROTHERMAL METHOD

In this project, europium-doped yttrium phosphate powders (YPO₄:Eu³⁺) with a concentration of 6 mol% were synthesized by the hydrothermal method. The hydrothermal reaction conditions were 190 °C for 3 hours. Heat treatment was carried out at 750 °C for 3 hours to form the crystal structure. The addition of glycerol as a cosolvent was to prevent agglomeration and promote dispersion of the particles. The pH was adjusted from an acidic medium (pH = 4) to a neutral medium (pH = 7), with the dropwise addition of sodium hydroxide. The powders obtained were characterized by X-ray diffraction (XRD), infrared spectroscopy (IR) and photoluminescence (PL), to study the structural, chemical, morphological, and luminescent properties with respect to the Eu³⁺ present in the YPO₄ structure. The XRD results revealed the formation of the cubic phase without phase transformations or secondary phases. The lattice parameters were changed when YPO₄ was doped with Eu³⁺, because the ionic radius of Eu³⁺ is larger than that of Y³⁺. Therefore, it is verified that Eu³⁺ was included in the YPO₄ matrix. Using infrared spectroscopy, the bands attributed to the europium-doped yttrium phosphate were obtained, that is, the P-O and the O P-O at 1000, 642 and 618 cm⁻¹ respectively. Photoluminescence analyzes showed the emission and excitation bands at 594 nm and 230 nm, respectively. The energy transitions of europium 3+ were observed: 5D₀-7F₁, 5D₀-7F₂, 5D₀-7F₃, 5D₀-7F₄ at 600 nm, 630 nm, 650 nm, and 700 nm, respectively. On the other hand, the chromatic coordinates were orange red, which agrees with the ultraviolet-excited Eu³⁺ emission. On the other hand, the quantum yield of Eu³⁺-doped YPO₄ powders was 62.32%.

Keywords

Phosphors, Rare-earths, Europium, Luminescence, Hydrothermal.

Reference

J. Wu, C. Liu, H. Jia, Y. Qi, Optical properties, energy transfer and thermal stability of spherical nano-phosphor YPO₄:Eu³⁺:Sm³⁺, College of Materials and Metallurgy, Inner Mongolia University of Sciences and Technology (2022) 22-2313. <https://doi.org/10.1016/j.jlumin.2022.118791>.

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Author approval

I confirm

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