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Synthesis, characterization and photoluminescent property of In_2O_3:Eu

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Abstract – In this work, we report the synthesis of In_2O_3:Eu powders by microwave-hydrothermal method, your morphology and optical properties. The autoclave was heated for 1h at 140 °C. The powders were structurally characterized using X-ray diffraction (XRD), Raman spectroscopy and Photoluminescence (PL) experiments. The emission spectra of samples under excitation of 350 nm present the characteristic Eu^{3+} transitions. The relative intensities of the Eu^{3+} emissions increase as the concentration of this ion increases from 1 to 8 % mol.

Indium oxide (In_2O_3) is a important n-type transparent semiconductor (TCO) with wide band gap (direct band gap around 3.6 eV), which has many possible applications in optical and electric devices, solar cells, liquid crystal displays, flat-panel displays and photocatalysts. Rare earth ions like Eu^{+3} and Er^{+3}, are incorporated in semiconductors, The optical properties of rare earth ions trapped in host lattices have received much attention in terms of technological importance. In this work, we report the synthesis of cubic phase In_2O_3:Eu^{3+} by microwave-hydrothermal method. The doping concentrations of Eu^{3+} are 1, 2, 4 and 8 mol %. The reaction system was heat treated at 140 °C for 1 h, using a heating rate fixed at 25 °C/min. After being cooled to room temperature, the white precipitate ($In(OH)_3$ precursor) was collected by centrifugation, washing with water. In_2O_3 were obtained from the precursor $In(OH)_3$ via calcination in a domestic microwave oven (MO) at 500 °C for 5 min, using a heating rate fixed at 25 °C/min. In order to study the structural and optical properties and the morphology, these powders were characterized X-ray diffraction (XRD), Raman spectroscopy and Fourier transformed infrared (FTIR) spectroscopy. Fig. 1 illustrates PL spectra recorded at room temperature of $In(OH)_3$ precursor powders at excitation wavelength 350 nm. The samples presented in their emission spectra (Fig. 1 a–e): $^5D_0$ to $^7F_0$, $^5D_0$ to $^7F_1$, $^5D_0$ to $^7F_2$, $^5D_0$ to $^7F_3$ and $^5D_0$ to $^7F_4$ transitions at around 579, 591, 613, 650 and 699 nm, respectively. In_2O_3 powders were prepared via dehydration of $In(OH)_3$. After annealing (Fig. 2) at 500 °C for 5 min, the XRD patterns showed all of the peaks were indexed to a single cubic phase. The In_2O_3:Eu has been efficiently synthesized using microwave-hydrothermal method and after annealing methods at moderate temperature.

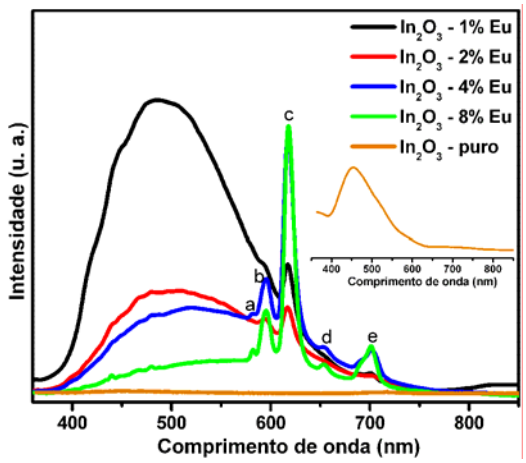

Figure 1. PL spectra of $In(OH)_3$ precursor under excited wavelengths of 350 nm at room temperature.

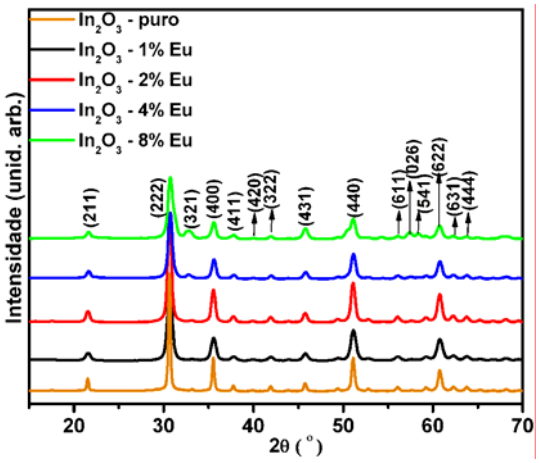

Figure 2. XRD patterns of the as formed In_2O_3:Eu^{3+} powders.

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