

## ABSTRACT

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As a small contribution to the evolution of science and technology of luminescent materials in the present work reported the research, synthesis and morphological, structural, of chemical composition and photoluminescent characterization of hafnium oxide films intrinsic and activated with dysprosium, deposited by ultrasonic spray pyrolysis technique. The deposits were made on glass substrates Plain Glass Slide (Unfrosted) marks IACS, cut into dimensions of 1 by 1.5 cm, with a thickness 1.2 mm, cleaning them to remove any contamination was carried out following the relevant protocol.  $\text{HfCl}_2\text{O} \cdot 0.8\text{H}_2\text{O}$  reagent was used (MW = 409.52) as a precursor of hafnium oxide and  $\text{DyCl}_3 \cdot \text{XH}_2\text{O}$  (MW = 268.86) as a precursor of dysprosium, both from Alfa Aesar, purity 98 % and 99.9 % respectively, are 0.05 M solutions prepared using deionized water as  $\text{HfCl}_2\text{O} \cdot 0.8\text{H}_2\text{O}$  solvent concentrations were varied impurificante 1, 1.5, 2, 3, 5, 10 and 20 % atomic dysprosium with respect to the amount of hafnium in the precursor solution and the deposition temperatures in the range of 300 to 600 °C in increments of 100 °C, in order to determine the optimum conditions of deposit which allowed the synthesis of films with the best luminescent properties. Fixed parameters were used as the distance between the nozzle and the substrate of 5 mm, air drag of 10 ml/min, the frequency of 0.8 MHz ultrasonic generator and the time of deposit of each film was 10 minutes. Surface morphology was determined using scanning electron microscopy (SEM). Micrographs were obtained intrinsic films observed the formation of a microstructure in the form of veins at low deposition temperatures, as a result of the impact of liquid-phase material on the substrate. In general, appreciated films compact, rugged with thickness of 10  $\mu\text{m}$  and uniform distribution of material deposited, films with good adhesion to the substrate at temperatures of 400 and 500 °C, with increasing temperature deposit thicker films were obtained and rough with formation of spherical structures arranged on its surface. At high deposition temperatures (600 °C), observed the formation of clusters of spherical particles uniformly distributed. The micrographs obtained from the films doped with 10 % atomic dysprosium in the precursor solution, show little difference compared to the intrinsic films. The elemental composition was determined by energy dispersive spectroscopy (EDS). The spectra obtained showed the

presence of chlorine in the films, which decreases with increasing temperature. The ratio Hf/O is closer to the ideal stoichiometry (0.5) with increasing deposition temperature, although on average only achieved a ratio of Hf/O=0.48 for films deposited at 600 °C. As for dysprosium, in general it was observed that incorporation into the matrix is favored with increasing temperature. The crystal structure was determined by *X* ray diffraction. At temperatures lower than 400 °C showed no crystalline films, with increasing deposition temperature increases the crystallinity, the XRD patterns of the films obtained at temperatures above 400 °C showed the intensification of the peaks, which when indexed and compared with the letters of diffraction of cubic phases, orthorhombic and monoclinic hafnium oxide, it was determined that this is the monoclinic phase with a preferential orientation of the planes (-111). The luminescent properties were evaluated by photoluminescent emission spectra (FL) observed that most FL emission intensity was presented in the films deposited at 600 °C due to increased crystallinity at this temperature, moreover, that the concentration of dopant 1.5 % atomic dysprosium in the precursor solution, the emission intensity of FL was highest, performing peak emission centered at 579 \*, 583 \*, 670 and 764 nm which corresponded to transitions  $^4F_{9/2} \rightarrow ^6H_J$  ( $J=^*13/2, 11/2$  and  $9/2$ , respectively) characteristic of  $Dy^{3+}$ . The peak centered at 579 nm was the most intense emission corresponding to the color yellow.