Synthesis and characterization of SiO_2 glass monoliths containing base Eu^{3+} for possible application in optical fibers.

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Monoliths based on Rare Earths (RE^{3+}) doped glasses prepared via sol-gel process are considered as promising materials for the different application in photonic areas. Silica matrices may be used as a great support for ions emitting, for instance Eu^{3+}. However, some studies are under development to avoid the cracks in monoliths, control of nanoparticles inside of monoliths to avoid the opacity, control of stress, among others. Moreover, another great problem is the low intensity of the photoluminescence properties showed by these kind of materials under excitation at UV-Vis region. [1] In this sense the aims of this work is to obtain Eu^{3+}-doped monoliths based on SiO_2 and to evaluate the optical properties for possible application in fiber optics manufacturing, solar cells or even Fabry-Pérot cavity. The materials were prepared via sol-gel process using TEOS, acetic acid, alcohol, and solutions ethanol containing Y^{3+} and Eu^{3+} as a precursor. After the drying time, the xerogels were heat-treated at 700 ° C in an oven until obtaining densified material and with a high degree of transparency. The materials were characterized, and a DSC analysis, it was found the glass transition of the material around 254 ºC. Monoliths showed intense emission in the red region under excitation at 250nm, 394nm and 463nm. Emission spectra showed band assigned to the Eu^{3+} with maxim positioned at 612 nm concerning the characteristic transition of this ion ($^5D_0 \rightarrow {}^7F_2$). Analyzes were made of the lifetime of the material, obtaining two lifetimes values for each wavelength of excitation. The obtained values showed range between 0.6 and 2.0 ms. The materials obtained had a high degree of transparency, with 75% transparent below 300nm and 90% transparent above 500 nm and were then classified as glass, due to the presence of the glass transition. The Y^{3+} acted as a co-dopant, forming a crystalline matrix within the amorphous silica, in order to house the europium ion and thus increasing the emission intensity of the material. The shape of monoliths obtained and optical properties observed make them excellent material for possible application in solar cells, Fabry-Pérot for laser application and also for waveguides in fiber optics shape.

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