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THE MORPHOLOGY, STRUCTURE AND LUMINESCENT PROPERTIES OF Gd_2O_3:Eu SYNTHESIZED BY AEROSOL ROUTE AND HIGH ENERGY BALL MILLING

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The processing of europium-doped gadolinia (Gd_2O_3:Eu) nanostructured particles has been realized using the bottom-up chemical approaches either by a hot-wall spray pyrolysis technique (SP), starting from the aerosol of common nitrates precursors, or a high energy ball milling (HEBM) of acetate precursors. The former one yields high-purity nanostructured non-agglomerated particles having spherical morphology and high chemical homogeneity. The HEBM-derived particles are with irregular morphology, submicronic in size, having an amorphous structure after 12h of milling. The detailed study of the crystalline structure and luminescent properties were proceeded for the different europium concentrations (1, 2 and 6at%) by means of XRPD, SEM, DSC, FTIR and steady state-fluorescent spectroscopy. The phase development and structural changes, followed by Fullprof program, implied the nanocrystalline inner structure (crystallites < 20 nm) and the coexistence of the following crystal phases for as-synthesized SP samples: two cubic phases, having either a bcc (SG: *Ia3*) or a fcc (SG: *Fm-3m*) structure, and a monoclinic phase with the space group (SG) *C2/m*. In the cubic *Ia3* phase the cell parameter was affected by the europium concentration and the thermal treatment temperature, followed with progressive increase in crystallite size. On the other side, the monoclinic phase concentration decreased after additional thermal treatments. Luminescence measurements have detected the presence of divalent europium near to 480 nm, aside to the typical trivalent europium spectra. This behavior could explain the increase in the emission intensity in the blue spectral region due to the divalent europium.