LUMINESCENT PROPERTIES OF TRANSPARENT NANOSTRUCTURED Eu^{3+} DOPED SnO_2-SiO_2 GLASS-CERAMICS PREPARED BY SOL-GEL METHOD

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There is a growing interest in transition metal and rare-earth ions doped nanoparticles due to their size-dependent physical properties and potential applications in optoelectronic technology (high brightness displays, laser emitters, fluorescent markers, . . .).[1] Tin oxide (SnO_2), on the other hand, is a very important n-tipe semiconductor with a wide band gap (E_g = 3.6 eV at 300 K) with different interesting applications (gas sensor, transparent conducting electrode, . . .).[2]

Glass-ceramics of the system (100-x)SiO_2-xSnO_2 with x from 1 to 10, doped with 0.4 mol% of Eu^{3+} have been prepared by thermal treatment of precursor sol-gel glasses; where dependence on annealing temperature and time has been analyzed. The segregated SnO_2 nanocrystals present a size distribution dependent on the preparation conditions. The samples structural analysis have been made by High Resolution Transmission Electron Microscopy (HRTEM) and X-ray Diffraction (XRD). The obtained mean nanocrystal sizes, with radius ranging from 2 to 10 nm, are comparable to the bulk exciton Bohr radius, corresponding to a wide band-gap quantum-dot SnO_2 system in an insulator SiO_2 glass. In these strong confinement conditions the energy gap presents a high dependence on the nanocrystal size.[3] Taking advantage of this effect, it has been possible to excite selectively the Eu^{3+} ions located in the SnO_2 nanocrystal, by energy transfer from the semiconductor host[4], obtaining different Eu^{3+} emission spectra and lifetimes for each nanocrystal size. Moreover, the spectroscopic properties of the Eu^{3+} ions in the SnO_2 nanocrystals have been compared with those of the ions remaining in the silica glassy matrix.

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