Morphological and Spectroscopic Characterization of Core@Shell Eu^{3+} doped Y_2O_3 and Y_2SiO_5@SiO_2 Nanoparticles

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Rare-earths doped materials have been extensively studied for many applications such as lasers, light emitting and biomarkers[1]. Optical biomarkers are gaining space in the research area once used appropriate wavelength, these can detect cells and tissues. In the case of Eu^{3+} doped nanoparticles, the bioimaging can be made with temporal resolution for discriminating the biological environment luminescence, which represents a great advantage compared to systems involving labeling by other methods including organic molecules and quantum dots. Different Eu^{3+} doped $Y(OH)CO_3$ particles with were prepared by homogeneous precipitation method with urea decomposition using $Y(NO_3)_3$, $Eu(NO_3)_3$ and different concentration of urea solution (0.5, 2 and 5 $mol.L^{-1}$) as precursor. The TEOS coating was perform by the traditional Stober method. After the obtained particles were isolated and annealed at 900 °C for 2 hours. The XDR analysis showed the majority Y_2SiO_5 monoclinic phases and typical peaks of Y_2O_3 cubic. According to TEM images, spherical and monodispersed particles with average diameter around 300, 150 e 100 nm was observed for the core@shell particles prepared with 0.5, 2 and 5 $mol.L^{-1}$ respectively. A thickness of 6 nm was observed for both particle shells. The emission spectra perform under 394 nm excitation showed a large number of Stark components, assigned to $^5D_0 \rightarrow {}^7F_{(0\text{-}4)}$ transitions, typical of Eu^{3+} ions in Y_2SiO_5 which can to substitute four distinct symmetry sites with coordination number 7 and 8. Furthermore, it was observed characteristic peaks of C_2 symmetry in the Y_2O_3 cubic. The lifetime ($\tau_{1/e}$) of $^5D_0$ level of Eu^{3+} ions ranging from 1.98, 2.25 and 2.43 ms according to increasing of urea concentration. The intense luminescence observed of Eu^{3+} doped Y_2SiO_5@SiO_2 particles expresses the potential for technological application on photonics and biophotonics, especially as biological markers.

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The authors would like to thank FAPESP, CAPES, and CNPq for financial support.