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Preparation and photoluminescence properties of functionalized silica submicron-sphere materials decorated with Eu(tta)$_3$·FX complex (FX= fluoxetin)

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Highlights

The incorporation of Eu(tta)$_3$·FX complex into modified silica particles results in hybrid materials. 3D spectra for Eu(tta)$_3$·FX in the VUV region revealed a high emission band originated from Eu^{3+} transitions.

Resumo/Abstract

The development of functionalized silica particles containing luminescent materials has received special attention because of their biological applications such as optical markers in vitro and in vivo, clinical diagnosis and drug delivery. The incorporation of Eu^{3+}-complex into modified silica particles combines optical characteristics of Eu^{3+}-complex and properties of inorganic oxides, resulting in organic-inorganic hybrid materials.
In this work, we synthesize and characterize sub-microspheres of SiO_2 decorated with a new complex of Eu^{3+} and fluoxetine, an antidepressant of the selective serotonin reuptake inhibitor (SSRI) class. The Eu-complex and the submicron-spheres (ϕ~500nm) were characterized optically and photo-physical characteristics of these materials were examined spectroscopically. In emission spectra of complex (Fig 1.a), four characteristic peaks of Eu^{3+} ion with the maximum at ~580 nm, ~595 nm, ~614 nm, and ~702 nm accredited to $^5D_0 \rightarrow {}^7F_J$ (J = 0-4) transitions appeared upon excitation in UV region. The most intense peak at 614 nm is accountable for the bright red emission of the ternary complex. For the SiO_2 nanospheres decorated with the complex these transitions are close to the complex but are identified the change in the symmetry around the Eu^{3+} ion when analyzing the spectra. Experimental intensity parameters (Ω_λ), lifetime (τ), radiative (A_{rad}) and non-radiative (A_{nrad}) coefficients, and intrinsic quantum yield ($Q_{Eu^{3+}}^{Eu^{3+}}$) values were determined. 3D emission spectra for the Eu(tta)$_3$·FX complex in the VUV region (Fig. 1b) revealed a high emission band originated from (Eu^{3+}) $^5D_0 \rightarrow {}^7F_{2,4}$ transitions (centered around 614 and 702 nm) under excitation at near bandgap energy. Color purity and CIE parameters also suggest the red luminous behavior of complex. Thermal and morphological behavior of the Eu-complex and submicron-spheres decorated with the Eu(tta)$_3$·FX complex are also evaluated (Fig1c). Our investigation has revealed that the synthesized complex and inorganic hybrid materials could be used in preparing lighting systems, OLEDs, display devices and biological sensors owing to their luminescent characteristics

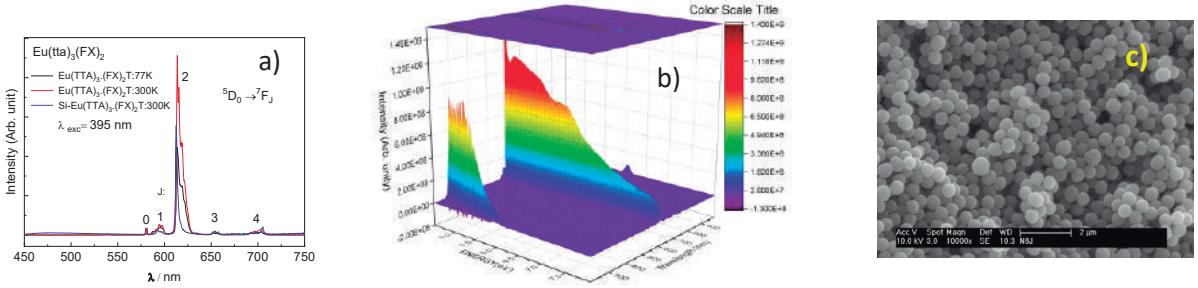

Fig 1. (a)Emission spectra of Eu(tta)$_3$·FX complex and SiO_2-Eu(tta)$_3$·FX hybrid materials, b) Synchrotron Vacuum-UV 3D spectra of Eu(tta)$_3$·FX and c)SEM image of SIO_2 submicron-spheres

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