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Inorganic-organic Luminescent Hybrids $Y_2O_3:Eu^{3+}@SiO_2[Tb(acac)_3(dmso)(sal)]$ and $Y_2O_3:Eu^{3+}@SiO_2[Tb(acac)_3(4\text{-}maba)]$: Synthesis and Optical Investigation

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Luminescent hybrids of core@shell type are materials that are well-investigated in luminescence chemistry due to their possible structural variability and diversity of applications. An example of this applicability is the development of luminescent probes for biological systems and multifunctional devices, such as LEDs, solar concentrators and optical sensors. The hybrids introduced here consist in a *core* of $Y_2O_3:Eu^{3+}$ coated by an organofunctionalysed silica *shell*, decorated with Tb^{3+} β-diketonates luminescent complexes, aiming to produce materials with specific and innovative properties, combining the individual characteristics of their components[1,2]. Therefore, in this context, two types of hybrid systems were developed via homogeneous precipitation and modified Stöber method: $Y_2O_3:Eu^3@SiO_2[Tb(acac)_3(dmso)(sal)]$ and $Y_2O_3:Eu^3@SiO_2[Tb(acac)_3(4\text{-}maba)]$, where acac = acetylacetone; sal, salicylaldehyde; dmso, dimethyl sulfoxide; and 4-maba, 4-(methylamine)benzoic acid. To prove and investigate the formation of such hybrids, morphological, structural and photophysical studies were carried out using scanning electron microscopy (SEM), X-ray diffraction (XRD) and photoluminescence (PLS) techniques. SEM images reveal spherical particles of the $Y_2O_3:Eu^{3+}$ core. The diffraction profile of the core before and after silica coating is characteristic of the cubic Y_2O_3 phase, JCPDS Card no. 41-1105, and after the inclusion of silica a halo appears indicating the presence of non-crystalline material. Regardless of the ligand used to complete the Tb^{3+} coordination sphere on the surface of the particles, the emission spectra with excitation in the UV region (328 nm) exhibited narrow bands between 490 and 710 nm characteristic of the $^5D_0 \rightarrow {}^7F_j$ (J = 1 to 4) Eu^{3+} transitions and the Tb^{3+} $^5D_4 \rightarrow {}^7F_j$ (J = 5 and 6) transitions. These results indicate that in this configuration both red and green emission are observable from the dopant present in the core and from the complex anchored on the surface, respectively, proving the success of the adopted strategy to get a dual emission system in only one material.

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References

[1] X. Wang *et al*, Journal of nanoscience and nanotechnology, **18**, 6 (2018).
[2] C. André *et al,* Journal of Alloys and Compounds, **843**,(2020).