

MOLTEN LIGAND SYNTHESIS METHOD AND LUMINESCENCE STUDY OF RE³⁺ COMPLEXES WITH ADIPATE

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The rare earth ions (RE³⁺) luminescent compounds have attracted much interest in the last few years, due to their intrinsic spectroscopic behavior and commercial applications in different areas such as: organic light-emitting diodes (OLEDs), optical markers, catalyses^{1,2} etc. This work presents the molten ligand synthesis method of RE³⁺ complexes, characterization and luminescent properties of the [RE₂(ADP)₃(DPSE)₃] compound where RE: Eu³⁺ and Tb³⁺; ADP: adipic acid (hexanedioic acid) and DPSE: diphenyl sulfone. The lanthanides complexes were synthesized by molten ligand solid state method that, to the best of our knowledge, it is unreported in the literature for this compounds, using the rare earth chloride and the ADP and DPSE ligands, which have the advantage of present low melting points at around 96 and 152 °C, respectively. The characterization of the complexes were carried out via elemental analysis (CHN), thermal analysis (TG/DTG), x-ray diffraction by the powder method (XPD) and infrared spectroscopy with Fourier transform (FTIR). The infrared absorption spectra indicate that the ligand-metal interaction is via chelate-bridging and their XPD patterns suggest high crystallinity and that the complexes present isomorphous character. The principal photoluminescence properties were determined based on the emission spectra of the Eu³⁺ and Tb³⁺ complexes, presenting a strong intense red and green emission colors, under UV excitation at 394 and 378 nm, respectively. Moreover, the spectra show narrow emission bands characteristic of the ⁵D₀→⁷F₀₋₄ transitions of the Eu³⁺ and the ⁵D₄→⁷F₆₋₀ transitions of Tb³⁺ ion. The absence of the broad emission band from the triplet states (T₁) of the organic ligands in the spectral range from 400 to 600 nm is also consistent with an efficient ligand-to-metal intramolecular energy transfer to the emitting levels of Eu³⁺ and Tb³⁺ in the complexes. The emission quantum efficiency of ⁵D₀ level and the 4f-4f experimental intensity parameters of the Eu³⁺ ion will be discussed.

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