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Photoluminescent properties of novel lanthanide complexes containing bis(diphenylphosphine) oxide and diketonate ligands

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Coordination compounds of trivalent lanthanide ions (Ln^{3+}) are widely studied due to their unique photophysical properties. In the literature it is possible to find several applications for these compounds, highlighting their use as luminescent probes in fluoroimmunoassays and emitting layers in organic light-emitting diodes. The forbidden nature of the intraconfigurational-4f transitions of lanthanide ions leads to low molar. Therefore, to overcome the low emission intensity, and develop compounds with high emission intensity, organic ligands with high absorption coefficients in the UV-Vis region are chosen to act as luminescence sensitizers in the intramolecular energy transfer from ligand to metal ion. Therefore, this work reports the synthesis, characterization and studies of the structural and luminescent properties of new compounds of trivalent lanthanide ions (Ln^{3+}: Eu^{3+}, Tb^{3+} and Gd^{3+}) containing auxiliary the ligand bis(diphenylphosphine) oxide ($dppeO_2$) with aliphatic spacers and ligands β-diketonates (β-dic: dpm, dbm, tta and btf) with general formula $[Ln(\beta\text{-dic})(NO_3)_2(dppeO_2)]$. The synthesized complexes were characterized using infrared absorption spectroscopy, thermogravimetric analysis, diffuse reflectance and luminescence spectroscopy. Diffuse reflectance spectra showed the presence of low-energy ligand-metal charge transfer (LMCT) states in these compounds. The emission spectra of the europium compounds exhibited narrow bands arising from the intraconfigurational-$4f^6$ transitions and the Judd-Ofelt intensity parameters were calculated. The mechanisms of intramolecular ligand-Ln^{3+} ion energy transfer for the new compounds were elucidated with the aid of the JOYSpectra platform.

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References

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