

Structural and Spectroscopic Properties of Lanthanide Coordination Polymer (Ln-CPs) with N-phthaloylglycinates and N-(2-carboxybenzoyl)glycinate

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Highlights

New structure of the Ln³⁺-(N-phthaloylglycinate) coordination polymer and mixed Eu–Tb compounds with efficient ligand to lanthanide (Ligand → Ln³⁺) and terbium → europium energy transfers.

Resumo/Abstract

Coordination polymers (CPs) designed by lanthanide (Ln³⁺) ions and organic ligands have attracted great interest for different applications in areas such as tunable luminescence, thermometry, chemical sensing, catalysis, and X-ray scintillator. Herein, structural and spectroscopic properties of the Ln³⁺ coordination polymers (Ln-CPs) have been synthesized with N-(2-carboxybenzoyl)glycinate (cbgly) and N-phthaloylglycinate (phtgly), {[Tb(phtgly)₃(H₂O)_x·xH₂O]_∞} and {[Eu(phtgly)(cbgly)(H₂O)₂(H₂O)]_∞} CPs as well as those mixed [Tb_{1-x}Eu_x(phtgly)(cbgly)(H₂O)₂(H₂O)]_∞ (x = 0.25, 0.50 and 0.75) are discussed. Structural data revealed that the shortest distances between Ln³⁺ ions in these CPs are found between 4.0 and 5.3 Å (Figure 1a). Based on the PL spectra of the Ln-CPs, we can suggest that the ligand absorption via S₀→S₁ transitions produces intense luminescence from the Tb³⁺ (CP1 and CP2) and Eu³⁺ (CP6) material respectively (Figure 1b). Additionally, in the mixed system Tb_{1-x}Eu_x–CPs, x = 0.25, 0.50 and 0.75 (CP3–CP5), as can be observed in the photoluminescence (Figure 1c) and X-ray excited optical luminescence (XEOL) (Figure 1d) spectra of the mixed Tb–Eu coordination polymer, the intensities of the bands arising to the ⁵D₀→⁷F_J (Eu³⁺) are significantly higher than those ones from ⁵D₄→⁷F_J (Tb³⁺) transitions even at low concentration of the “dopant” ion. This behavior can be explained by the high efficiency in the energy transfer from Tb³⁺ to Eu³⁺ ion. The Tb³⁺→Eu³⁺ energy transfer process was also investigated from the luminescence decay curves, the lifetime value for ⁵D₄ level for Tb-CPs (τ = 1.177 ms) decreases deeply to 0.134 ms for x = 0.25 in (CP3), indicating a very efficient luminescence quenching of the Tb³⁺ ion by the Eu³⁺ ions close to emitting metal. In this way, the transfer efficiency Tb³⁺→Eu³⁺ of η_{ET} ≈ 90% were determined.

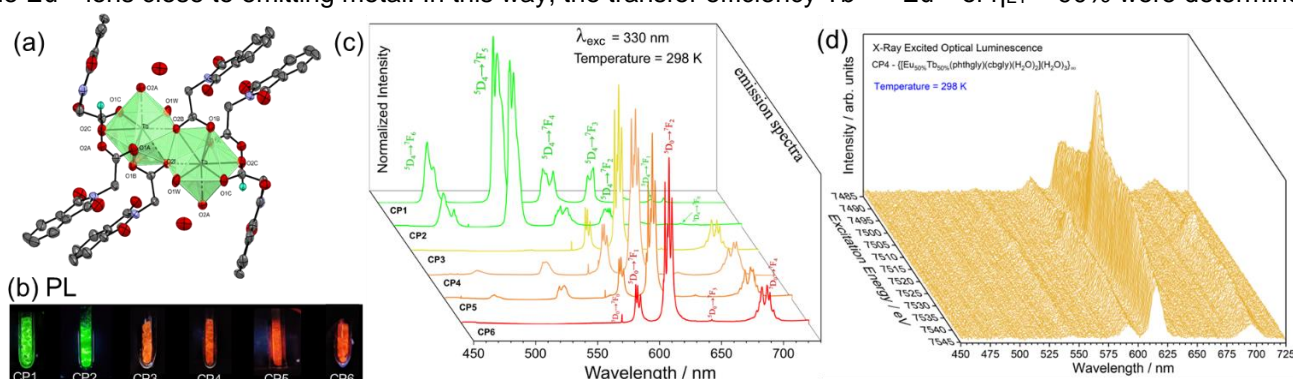


Figura 1. a) Structure of the Tb³⁺ coordination polymer CP-1. b) Photographs of the CP1 to CP6 (under 330 nm UV light) compounds, c) PL spectra of de CP1 to CP6 at 300 K, and XEOL spectra of the [Tb_{0.5}Eu_{0.5}(phtgly)(cbgly)(H₂O)₂(H₂O)]_∞ at 300 K.

Reference

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