Área: INO

A case of abnormally high intensity parameters in Eu(III)-indandionate complexes

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Highlights

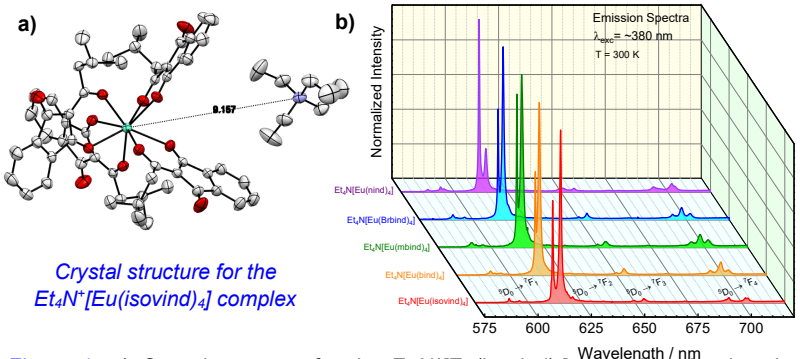
The highest value of Judd–Ofelt intensity parameter (Ω_2) for the europium (III) compound reported in the literature. The Eu(III)-indandionate complexes exhibit high PLQYs (Q^L_{Eu}) in solid state.

Resumo/Abstract

Luminescent coordination compounds based on trivalent europium ions (Eu^{3+}) materials have attracted much attention in the last decades due to their potential applications, such as optoelectronics, molecular thermometers, and biomedical devices. The most important features of these materials may be associated with narrow emission bands, which arise from intra-configurational Laporte forbidden 4f – 4f transitions ($^5D_0 \rightarrow {}^7F_J$). On the other hand, the energy structures of the organic ligands in the complexes play the most important role in the Eu^{3+} luminescence sensitization process[1]. In this context, this work reports about theoretical, syntheses, structural (Figure 1a), vibrational (FTIR/Raman) and photoluminescence studies of a series of tetrakis complexes containing tetraethylammonium, $Et_4N^+[Ln(acind)_4]^-$ (Et_4N^+: tetraethylammonium cation, Ln: Gd and Eu, and acind: 2-acyl-1,3-indandionate). The experimental intensity parameter (Ω_λ), lifetime (τ), radiative (A_{rad}) and non-radiative (A_{nrad}) coefficients, intrinsic quantum yield (Q^{Eu}_{Eu}) and experimental absolute luminescence quantum yield values (Q^L_{Eu}) were calculated (Table 1). Furthermore, the intrinsic quantum yield (Q^{Eu}_{Eu}) are in excellent agreement with the experimental absolute luminescence quantum yield values (PLQYs). Studies of luminescent properties have shown that tetrakis Eu^{3+} complexes with acind ligands presents high intensity emission (Figure 1b). These results suggesting that these complexes constitute a new class of coordination compounds with great potential for application as red emitting layer in OLEDs.

Table 1. Experimental intensity parameters (Ω_λ/ in 10^{-20} cm^2), lifetime (τ/ms), radiative (A_{rad}/ in s^{-1}) and non-radiative (A_{nrad}/ in s^{-1}) coefficients, intrinsic quantum yield (Q^{Eu}_{Eu}), and experimental absolute luminescence quantum yield (Q^L_{Eu}/%) for the $Et_4N^+[Eu(acind)_4]^-$ complex at 300 K.

Complexes $Et_4N^+[Eu(acind)_4]^-$	Ω_2	Ω_4	τ	A_{rad}	A_{nrad}	Q^{Eu}_{Eu}	Q^L_{Eu}
$Et_4N[Eu(isovind)_4]$	73.5	8.9	0.337	2468	562.3	81.4	80
$Et_4N[Eu(bind)_4]$	59.1	13.0	0.299	2109	1235	63	61
$Et_4N[Eu(mbind)_4]$	46.3	11.5	0.201	1673	2286	42.3	40
$Et_4N[Eu(Brbind)_4]$	49.0	12.7	0,306	1782	1487	54.5	54
$Et_4N[Eu(nind)_4]$	29.1	9.5	0,513	1131	817.5	58.0	60



Crystal structure for the $Et_4N^+[Eu(isovind)_4]$ complex

Figure 1. a) Crystal structure for the $Et_4N^+[Eu(isovind)_4]^-$ complex showing the intermolecular interactions between Et_4N^+ cation and indandione groups in the structure of the $N(Et)_4[Eu(acind)_4]$ compound. b) Emission spectra of $Et_4N^+[Eu(acid)_4]^-$ complex from 300 K.

Reference

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