# Luminescent properties of rare earth tetrakis(β diketonates) complexes in imidazolium-based ionic liquids

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In the last decades the research of rare earth (RE) coordination compounds has greatly increased. This is because of their potential for application in the areas of electroluminescence, triboluminescence, optical markers, medical diagnosis, *etc*[1]. Most of the photoluminescent studies involving the $RE^{3+}$ β-diketonates are about *tris*(β-diketonate) complexes, which have the general formula $[RE(\beta\text{-diketonate})_3(H_2O)_x]$. However, in such complexes the coordinated water molecules act as luminescence quencher. This can be avoided with the addition of a fourth ligand, resulting in the anhydrous *tetrakis*(β-diketonates) complexes, which the general formula is $Q[RE(\beta\text{-diketonate})_4]$ (where $Q^+$ is a countercation). The countercation can be either an inorganic or organic ion.

Recently there have been several papers about the use of ionic liquids as solvents of $RE^{3+}$ tetrakis complexes[2]. It has also been reported an increasing of the photostability and quantum yields of $RE^{3+}$ complexes dissolved in ionic liquids (IL)[3]. The cation of the ionic liquid can also behave as a countercation and stabilize the complexes, and increase the luminescence by transferring energy to the $RE^{3+}$ ion.

This work deals with the synthesis, characterization and photonic properties of $Eu^{3+}$ tetrakis(β-diketonates) complexes in imidazolium-based ionic liquids. The IL used were 1-alkyl-3-methylimidazolium bromide ($[C_n$mim]Br, where *n* is the length of the alkyl chain on the imidazolium ring), while the β-diketonates where thenoyltrifluoroacetonate (TTA) or dibenzoylmethanate (DBM). The complexes had the general formula $[C_n$mim$][(\beta\text{-diketonate})_4]$, in which the chain length *n* was varied from 2 to 8.

The complexes were characterized by the following techniques: elemental analysis, infrared absorption spectroscopy and thermogravimetric analysis. Photoluminescent studies were made on the complexes in solid form and with them dissolved in the corresponding $[C_n$mim]Br IL. Furthermore, the optical properties were studied based on the emission and excitation electronic spectra. The effect of the alkyl chain length on these luminescent properties was also studied. Ultimately, new luminescent materials that act as Light-Conversion Molecular Devices (LCMD) were designed from the tetrakis(β-diketonates) complexes in the ionic liquids.

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