COORDINATION LUMINESCENTS COMPOUNDS OF LANTANIDES AND ELEMENTS OF GROUP 13 WITH BINDERS TYPE SUBSTITUTED β-HYDROXYMETHYLINDANONES

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Abstract

The invention comprises the efficient design and synthesis of coordination compounds (R-substituted hydroxymethylenedianones (LRH) binders) of lanthanides (III) and elements of group 13 (Boron and Aluminum (III)) that exhibit significant luminescence. The chelating binders are efficient photoluminescence sensitizers.

Background

This development is a continuation of the indanone complexes with vanadium and copper with application in semiconductor materials as well as boron complexes with fluorescent properties (Patent Application: MX/a/2016/016553 Hydroxybenzylidene-1-indanones and their complexes, synthesis and uses in the biological area and in the chemistry of materials.

Stage of research

The research group performed the synthesis of a series of binders through a simple and efficient synthesis method. The characterization of the compounds was also carried out using ^{1}H NMR spectroscopy (in some cases multielemental ^{1}H, ^{11}B, ^{19}F and ^{13}C), IR, UV-Vis and fluorescence, mass spectrometry ESI, FAB+, high resolution DART+, elemental analysis, magnetic susceptibility, melting point and thermogravimetric analysis. The crystalline structures of some complexes were obtained through the monocrystal X-rays diffraction and luminescence studies were carried out in solution of the series of complexes.

It has been found that the LRH binders produced are efficient antennas for sensitizing lanthanide ions, as well as that the incorporation of phenyl groups improves their luminescent properties. Additionally, it was demonstrated that the proposed LRH binders also manage to sensitize elements of group 13, boron (III) and aluminum (III), for which they are potential precursors for the preparation of materials with optoelectronic properties. The tris-chelate of Al (III) presented emissions in both solid and dissolved state, so it is proposed that it could also be used as a dopant or as a buffer layer for organic solar cells (OSC).

Description

The invention comprises the efficient design and synthesis of coordination compounds (R-substituted hydroxymethylenedianones (LRH) binders) of lanthanides (III) and elements of group 13 (Boron and Aluminum (III)) that exhibit significant luminescence. The chelating binders are efficient photoluminescence sensitizers. The applications of these compounds are present in several industrial fields.

Applications field

The Ln^{3+} compounds of the present invention can be applied to several fields, such as luminescent sensors with electromagnetic spectrum emissions in the visible (Eu^{3+} and Tb^{3+}) and NIR (Nd^{3+} and Yb^{3+}) regions, as emitters that can be incorporated in emissive layers for organic light-emitting diodes (OLED), luminescent probes based on molecular lanthanide compounds that have applications in bionanotechnology, nanomedicine and environmental protection; and magnetic materials based on molecules by the slow relaxation of magnetization as a security mark of official identification documents or money paper.

They can be used as efficient donors in luminescent energy transfer analyzes. This use could allow measurements of distances greater than 100 Å, which has a great importance in structural biology and medicine, and in addition making distance measurements more accurate, since the compounds are good energy transfer donors because of the low spectral or temporal superposition between the emission of the sensitizer and the emission of the lanthanides; this can minimize the uncertainty in the orientation-dependence of the energy transfer.

They could be useful as fluorophores hardened by radiation in X-ray microscopy.

The chelates of this invention could also be used as alternatives to conventional fluorescent dyes, especially in imaging applications, with the potential for contrast enhancement.

On the other hand, the compounds of this development obtained from the elements of group 13 can also be applied to polymer dopants to produce luminescent probes for the detection of O2. Dopants for the construction of functional luminescent materials with properties such as delayed fluorescence and phosphorescence at room temperature.

They can be assembled to nanoparticles to produce nanoparticles with medical applications for the detection with images of a good spatial and temporal resolution of hypoxia (oxygen deficiency) in vivo. As coloring dye sensitizers for efficient solar cells.

Advantages

The main advantages of this invention lie in the simplicity and efficiency of its synthesis method, as well as in the large number of fields of application they possess. In such a way that, from now on, other lines of research and development can be followed to explore and exploit the direct applications of these luminescent compounds.