XXI Brazilian Meeting on Inorganic Chemistry
X Brazilian Meeting on Rare Earths
III Workshop on Theoretical Bioinorganic Chemistry
Belo Horizonte, September 12 - 15th 2024

In situ and Ex Situ Luminescent Properties of Lanthanides-doped Layered Double Hydroxides Containing Mellitate Anion

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Thematic Area: Rare-Earths

Keywords: LDHs, Luminescence, lanthanide ions

Layered double hydroxides (LDHs) have received significant attention as a platform for developing smart luminescent materials for optical displays, biological imaging, and therapy applications.[1] Due to their anion and cation-exchange ability, several new luminescent materials have been obtained by controlling the chemical compositions and the spectroscopic characteristics of the interlayered guest molecules.[2] Furthermore, a synergistic interaction in the modified LDHs may lead to materials with unexpected properties from those of their components. In this study, LDHs-ZnAl doped with trivalent lanthanide ions (Ln^{3+}, Eu^{3+}, Gd^{3+} and Tb^{3+}), in which 15% of Al^{3+} ions have been substituted by the Ln^{3+} ions, containing the mellitate ion (MA^{6-}) in the interlayer gallery have been prepared at different temperatures and characterized by infrared spectroscopy, X-ray diffraction, thermogravimetric analysis, and diffuse reflectance spectroscopy. The results indicate that the Ln^{3+} ions and the organic anion were effectively introduced into the material without significantly losing the structural properties of LDHs. *In situ* and *ex situ* measurements reveal slight changes in the luminescent properties of the drying process. Highly luminescent materials with emission in the red, green and blue spectral regions have been obtained (Figure 1). Surprisingly, the unexpected blue luminescence from the LDH-doped Gd^{3+} has been ascribed to the long lifetime phosphorescence $T \rightarrow S_0$ transition. These results demonstrate that prepared materials present significant potential for developing white-light emission material for application in optical displays and lighting devices.

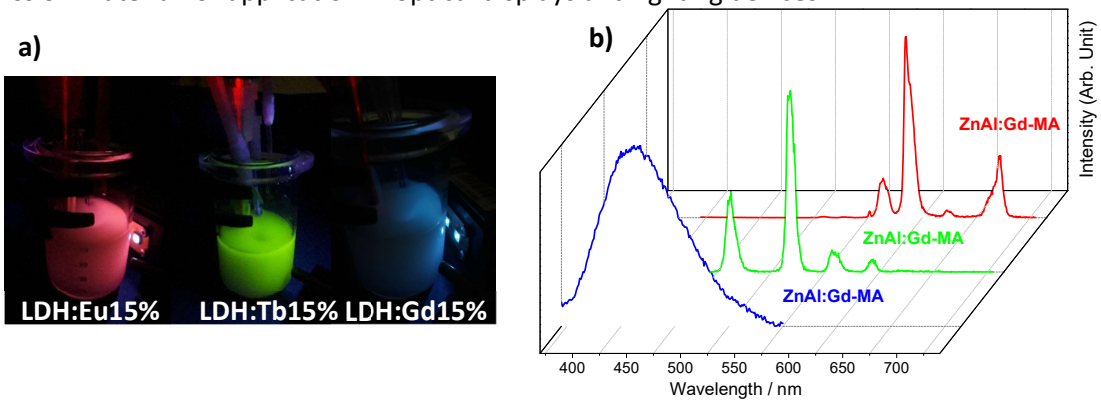

Figure 1: a) Photograph of Zn_2Al-LDH doped Ln^{3+} ions under UV irradiation; b) Emission spectra of the Zn_2Al-LDH doped Ln^{3+} ions after drying process.

Acknowledgments: We thank to the German Academic Exchange Service (DAAD) and CAPES, grants 88887.371434/2019-00 and 88887.371434/2019-00) for financial support.

References

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