XXII B-MRS Meeting 2024

September 29th to October 3rd

PROCEEDINGS

Investigation of Site-Selective Luminescence on Core-Shell Persistent Phosphors using Synchrotron Radiation

Leonardo Henrique Comini Francisco[1], Renan Paes Moreira[1], Hermi Felinto Brito[2], Oscar Loureiro Malta[3], Maria Cláudia França da Cunha Felinto[1]

[1]Instituto de Pesquisas Energéticas e Nucleares, [2]Institute of Chemistry, University of Sao Paulo, [3]Universidade Federal de Pernambuco

e-mail: leo.francisco@usp.br

With the growing interest in the development of multifunctional luminescent nanomaterials for applications in energy conversion and storage, several new methods have been studied for the fabrication of efficient core-shell persistent phosphors with long-lasting persistent luminescence in the visible and near-infrared range. Such materials often exhibit particular optical properties that may be precisely tuned via the modification of structural parameters and surface functionalization. [1-3] Hence, in this work, site-selective luminescence of core-shell green-emitting rare-earth-doped strontium aluminate persistent phosphors functionalized with europium β-diketonate (tta, dbm) complexes were investigated utilizing a combination of synchrotron-based techniques at the CARNAÚBA beamline of Sirius, such as X-ray absorption near edge structure (XANES), X-ray Excited Optical Luminescence (XEOL), and X-ray fluorescence (XRF). X-ray excited luminescence spectroscopy revealed that single-shell materials exhibit distinct emission profiles associated with energy-transfer mechanisms via the “antenna effect” for the different β-diketonate ligands, while double-shell materials showed that the ratio between Eu^{2+} (green) and Eu^{3+} (red) emission is intrinsically different for the edge and the bulk of the studied particles. Promising results also revealed the influence of shell thickness and distance in potential energy-transfer processes, outlining an important framework for the development of multifunctional persistent phosphors utilizing rare-earth complexes as luminescent sensitizers.

Acknowledgments:
The authors acknowledge the funding provided by the Brazilian agencies CNPq, CNEN, and FAPESP (Grant 2021/08111-2)

References:

[1] Y. Li, M. Gecevicius, J. Qiu, et al. Chem. Soc. Rev. 45, 2090-2136 (2016).
[2] X. Zhu et al., ACS Materials Lett. 4, 1815 (2022).
[3] L.H.C. Francisco, R.P. Moreira, M.C.F.C. Felinto, et al. J. Alloys Compd. 882, 160608 (2021).