Investigation of rare earth distribution in $Sr_2MgSi_2O_7:Eu^{2+},Dy^{3+}$ nanophosphors prepared by wet-chemical routes

E. Bonturim[1,*], R. dos Reis[2], L. G. Merizio[3], L. C. V. Rodrigues[3], H. F. Brito[3], M. C. F. C. Felinto[1]

[1] *Instituto de Pesquisas Energéticas e Nucleares, SP, Brazil.* [2] *National Center for Electron Microscopy, Molecular Foundry, LBNL, Berkeley, CA, USA.* [3] *Universidade de São Paulo, Instituto de Química, SP, Brazil.*

[*] *Corresponding author: ton.bonturim@gmail.com*

Luminescent materials have been developed through fine chemistry methods that help to achieve a better control of parameters such as morphology, particle size, atomic homogeneity and high purity single phase in low temperature synthesis.[1, 2] In this work, the material $Sr_{1.98}MgSi_2O_7$ nanoparticles doped with 0.01 mol of Eu^{2+} and codoped with 0.01 mol of Dy^{3+} was prepared via Pechini and Condensation methods. Post-annealing by microwave assisted method using granular coal as the susceptor/reducing agent [3] was applied on both materials and their luminescent properties were compared. The structural position of Eu^{2+} used as the activator ions determines photoluminescence properties. The luminescence spectra of $Sr_2MgSi_2O_7:R^{n+}$ nanomaterial (R: Eu^{2+}, Dy^{3+}) shows a high emission broad band assigned to the interconfigurational transition $4f^65d^1 \rightarrow 4f^7$ centered around 460 nm, which is overlapped with a low emission lines attributed to the $^4F_{9/2} \rightarrow {}^6H_{13/2}$ transition of Dy^{3+} ion (Fig. 1b). Elemental mappings obtained by Energy Dispersive X-Ray (EDX) presents dopants more likely to be found at the edge, indicating a possible segregation of rare earths to the grain boundaries during the synthesis (Fig. 1c). The persistent luminescence phenomenon emitting in a blue region was observed for both nanomaterials.

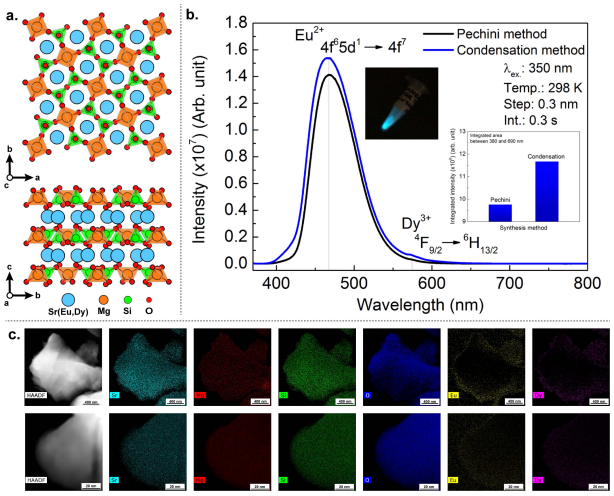

Figure 1: (a) Crystal structure of SMSO view along [001] and [100] axes. (b) emission spectra of both compounds. (c) 2D-elemental mapping of SMSO particles obtained by Pechini (top row) and Condensation (bottom row) methods.

Keywords: Persistent luminescence, wet-chemistry, rare earth, nanophosphors, microwave assisted.

Acknowledgements: The research was supported by Brazilian funding agencies CNPq (Scholarship Process N.142266/2013-2) and CAPES (Process N.9511/2014-08). Work at the Molecular Foundry was supported by the Office of Science, Office of Basic Energy Sciences, of the U.S. Department of Energy under Contract No. DE-AC02-05CH11231.

References

[1] Wen Pan et al. In: *J. Lumin.* 128 (2008), pp. 1975–1979.

[2] Xiaofei Qu et al. In: *J. Alloy. Compd.* 533 (2012), pp. 83–87.

[3] Cássio CS Pedroso et al. In: *ACS Appl. Mater. Interfaces* 8 (2016), pp. 19593–19604.