Luminescence properties of Eu^{3+} and Dy^{3+} ions in germanate ceramics Li_2AGeO_4 (A = Zn, Mg)

Nikola Bednarska-Adam#, Marta Kuwik, Wojciech A. Pisarski, Joanna Pisarska

University of Silesia, Institute of Chemistry, Szkolna 9, 40-007 Katowice, Poland

Inorganic systems have played a crucial role in technology, especially in advanced materials like color display devices and optoelectronic devices [1]. Optical hosts doped with lanthanide ions (Ln^{3+}) have garnered significant attention due to their luminescent properties [2]. Among these ions, Eu^{3+} and Dy^{3+} have emerged as prominent dopants for visible light emitters [2, 3]. Materials doped with Eu^{3+} exhibit orange-red luminescence, while Dy^{3+} ions contribute to visible emission in the blue and yellow spectral regions. Optical hosts containing Eu^{3+} and Dy^{3+} exhibit distinctive emission intensity variations due to their site-selective nature and local environment symmetry, analyzed using the red-to-orange luminescence intensity ratio R/O (Eu^{3+}) and yellow-to-blue luminescence intensity ratio Y/B (Dy^{3+}), respectively [4]. Among others, germanate ceramics with olivine structure are promising hosts for Ln^{3+} ions. Recent studies by Misevicius et al [5] showed intense yellow emission in $LiYGeO_4$ doped with Dy^{3+} ions, while Dai et al [6] observed long-lasting red persistent luminescence in $LiYGeO_4$:Eu^{3+} phosphors. Although some research has explored Ln^{3+}-doped $LiYGeO_4$ materials, luminescent investigations on Li_2MgGeO_4 and Li_2ZnGeO_4 doped with Eu^{3+} and Dy^{3+} have not been yet conducted.

In this study, luminescence properties of Li_2MgGeO_4 and Li_2ZnGeO_4 doped with Eu^{3+} and Dy^{3+} ions are presented and discussed. Based on emission spectra and their decays some spectroscopic parameters for Ln^{3+} were determined. Our results reveal promising optical properties, indicating their potential as inorganic visible emitters.

Acknowledgment: This research was funded by National Science Centre (Poland), grant number 2019/35/B/ST5/01924.

[1] Damodaraiah S., Reddy Prasad V., Vijaya Lakshmi R. P., Ratnakaram Y.C. (2019) Opt. Mater. 92, 352-358
[2] Chemingui S., Ferhi M., Horhcani-Naifer K., Ferid M. (2015) J. Lumin, 166, 82-87
[3] Andresen Ä., Bahar A., Conradi D., Oprea I., Pankrath R., Voelker U., Betzler K., Wöhlecke M. (2008) Phys. Rev. B., 77, 21410
[4] Han Q., Gao W., Qi J., Zhao X., Zhang J., Wang Y., Dong S., Liu W., Hao A., Dong J. (2019) J. Lumin 212, 227-232
[5] Misevicius M., Griniuk E., Ramanauskas R. (2023) Mater. Chem. Phys. 306, 128082
[6] Dai T., Ju G., Jin Y., Wu H., Hu Y. (2021) J. Lumin 237

corresponding author: nikola.bednarska@us.edu.pl