Stokes and anti-Stokes emission of $CaAl_2SiO_6$ polycrystals doped with Pr^{3+} ions

K. Lemański#, N. Rebrova, P. Zdeb, P. J. Dereń

Institute of Low Temperature and Structure Research, Polish Academy of Sciences,
Okólna 2, 50-422 Wrocław, Poland

Silicates and aluminosilicates belong to a large family of compounds useful in many areas. $CaAl_2SiO_6$ Yoshiokaite mineral structure was first collected from the Moon by the Apollo 14 crew in 1971. In the scientific literature, there are not many papers describing the luminescent properties of $CaAl_2SiO_6$. However, recently manuscripts have been published describing the properties of this aluminosilicate doped with rare earth and transition metal ions [1-3].

The Stokes emission of Pr^{3+} ions is characterized by the blue and red emission, which is mainly from the $^3P_0$ or $^1D_2$ energy levels to the ground state $^3H_4$, respectively. Also, the 5d→4f Stokes and anti-Stokes (see Fig. 1.) emission in the UVC range is observed. The UVC radiation (100-280 nm) is used for disinfection because it successfully destroys viruses and bacteria. Therefore, materials with emissions in the UVC range may find applications that are particularly useful for human health.

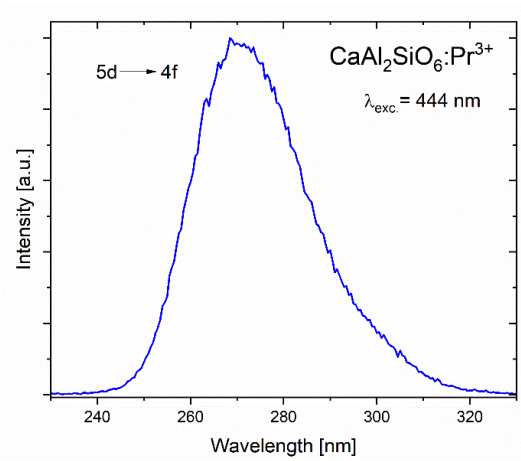

Fig. 1. The upconversion emission in the UVC range.

The synthesis of $CaAl_2SiO_6$ polycrystals doped with Pr^{3+} ions were carried out with using the solid-state method. The crystalline structures have been confirmed with the XRD measurement. The absorption, excitation, emission spectra, and time decay profiles of the praseodymium(III) ions were measured and analyzed. The studied aluminosilicate phosphors possess characteristics that confirm their potential in luminescent applications.

Acknowledgements: This work was supported by The National Science Centre (NCN) under the OPUS 21 project, grant no. UMO-2021/41/B/ST5/03792, which is gratefully acknowledged.

[1] K. Lemański, W. Walerczyk and P. J. Dereń (2016) J. Alloys Compd., 672, 595–599.
[2] K. Lemański (2023) Solid State Sci., 144, 107300.
[3] K. Lemański (2024) Bull. Mater. Sci., Springer Nature, 47, 70.

corresponding author: K.Lemanski@intibs.pl