Temperature Dependent Luminescence of $SrAl_{12}O_{19}:Eu^{2+},Eu^{3+},Cr^{3+}$ Thermometric Phosphors

Pola Łukaszczuk[1], Justyna Zeler[1], Małgorzata Sójka[1], Tadeusz Leśniewski, Sebastian Mahlik[2], Mikhail Brik[3], Michał Piasecki[3], Eugeniusz Zych[1#]

[1]University of Wrocław, Faculty of Chemistry, 50-383 Wrocław, 14 F. Joliot-Curies Street, Poland
[2]Institute of Experimental Physics, Faculty of Mathematics, Physics and Informatics, University of Gdańsk, Wita Stwosza 57, 80-308, Gdańsk, Poland
[3]Theoretical Physics Department, Jan Dlugosz University, Armii Krajowej 13/15, 42-200 Czestochowa, Poland

This research on inorganic phosphor $SrAl_{12}O_{19}$ doped with Eu^{2+}, Eu^{3+}, and Cr^{3+} presents exciting findings that could impact luminescent thermometry technology. This phosphor was characterized through photoluminescent measurements at temperatures from 12 – 1000 K, as well as at elevated pressures up to 30 GPa. The results revealed that Eu^{2+} and Eu^{3+} contributed to luminescence, and only the former's emission strongly depended on temperature. Cr^{3+} ions generated emission around 700 nm, and detailed studies at 12 K proved the presence of at least three sites of different symmetries. Figure 1 shows that their emissions differed in decay kinetics. The efficient 4f→5d absorption transition and energy transfer from Eu^{2+} to Cr^{3+} allow for effective excitation of their emissions, making the $SrAl_{12}O_{19}$ doped with Eu^{2+}, Eu^{3+}, and Cr^{3+} an attractive material for luminescent thermometer applications. High-pressure spectroscopy has demonstrated a negligible shift in the emission of Eu^{2+} and Eu^{3+}, indicating that the material could be used as a pressure-invariant luminescence temperature sensor in high-pressure environments. This research could have a significant impact on the field of luminescent thermometry, and the findings presented in this study will be discussed in detail to identify the most promising thermometric parameters available.

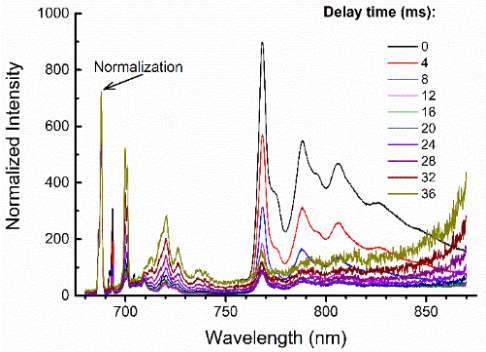

Figure 1. Time-resolved luminescence spectra of $SrAl_{12}O_{19}$ doped with Eu^{2+}, Eu^{3+}, and Cr^{3+} in the range of Cr^{3+} luminescence.

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corresponding author: eugeniusz.zych@uwr.edu.pl