# Simultaneous Measurement of the Emission Quantum Yield and Local Temperature: The Illustrative Example of $SrF_2$:$Yb^{3+}$/$Er^{3+}$ Single Crystals

**Carlos D.S. Brites**
*Co-author: Luís D. Carlos*
*Phantom-g, CICECO – Aveiro Institute of Materials, Department of Physics, Universidade de Aveiro, 3810-193 Aveiro, Portugal*
carlos.brites@ua.pt

Abstract

The emission quantum yield is one of the key figures of merit to evaluate the photoluminescence performance of luminescent materials. The emission quantum yield of upconverting materials is still not widely reported due to technical difficulties and intricate dependence on the excitation power density that is mirrored in a temperature increase.

In this presentation we will describe the simultaneous determination of the emission quantum yield (for both downshifting and upconverting processes) and of the temperature by using the output of a commercial integrating sphere[1]. The temperature is calculated by primary luminescence thermometry[2] through the Boltzmann equation, analysing the intensity ratio between the $^2H_{11/2}$, $^4S_{3/2}$→$^4I_{15/2}$ transitions of the $Er^{3+}$ ion. The procedure was illustrated using $SrF_2$: $Yb^{3+}$/$Er^{3+}$ single crystals with distinct $Yb^{3+}$ compositions and the effect of the $Yb^{3+}$ content on the emission quantum yield and the temperature increase of the sample.

References

[1] C. D. S. Brites, S. V. Kuznetsov, V. A. Konyushkin, A. N. Nakladov P. P. Fedorov, L. D. Carlos, Eur. J. Inorg. Chem., 17 (2020) 1555
[2] S. Balabhadra, M. L. Debasu, C. D. S. Brites, R. A. S. Ferreira, L. D. Carlos, J. Phys. Chem. C 121 (2017) 13962

Figures

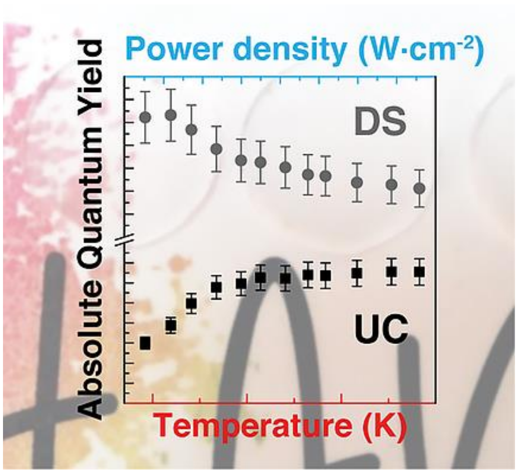


**Figure:** Temperature dependence of the down-shifting (DS) and upconverting (UC) absolute quantum yield in $SrF_2$: $Yb^{3+}$/$Er^{3+}$ sample.