On the incorporation of europium in $SrAl_2O_4$

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Glow-in-the-dark or persistent luminescence is already known for centuries and subject of scientific research since the discovery of the Bologna stone in 1602. Nevertheless, a lot of questions about this phenomenon are still unanswered today. This is certainly true for the established phosphor $SrAl_2O_4$:Eu, Dy, which is characterized by a well-known green afterglow [1].

What is often forgotten or neglected in the literature on $SrAl_2O_4$:Eu, Dy is the occurrence of a blue emission band which is only visible at low temperature and thermally quenched at room temperature. However, recent work has shown that this blue emission band is of importance in explaining the trapping and detrapping mechanism which lies at the fundaments of the persistent luminescence in this material [2].

In this work, we dwell upon the cause of this blue emission band. Different conflicting explanations are available in the literature. A theoretical approach delivered new insights on this question. It turns out that the green and blue emission bands are solely the consequence of the incorporation of Eu^{2+} on two nonequivalent Sr sites in the $SrAl_2O_4$ host material.

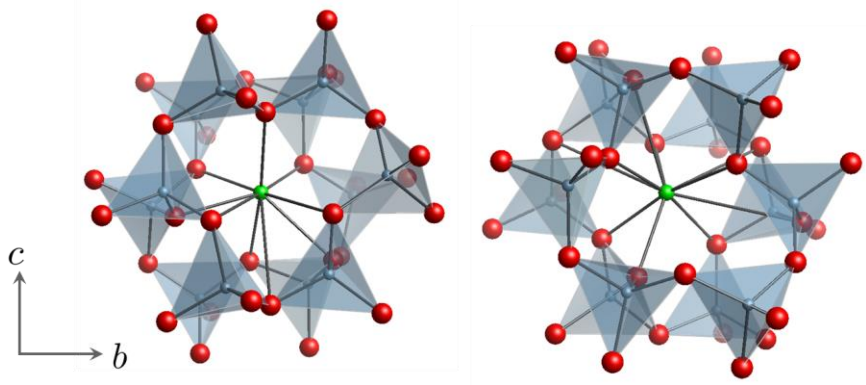

Fig 1. Europium clusters in $SrAl_2O_4$. Left: substituted on the Sr1 position, Right: on the Sr2 position.

[1] K. Van den Eeckhout, P. F. Smet D. Poelman, Materials 2010, 3, 2536-2566.
[2] J. Botterman, J. J. Joos, D. Poelman, P. F. Smet, Abstract PRE14.