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COMPARATIVE STUDY OF THE AFTERGLOW OF STRONTIUM ALUMINATES

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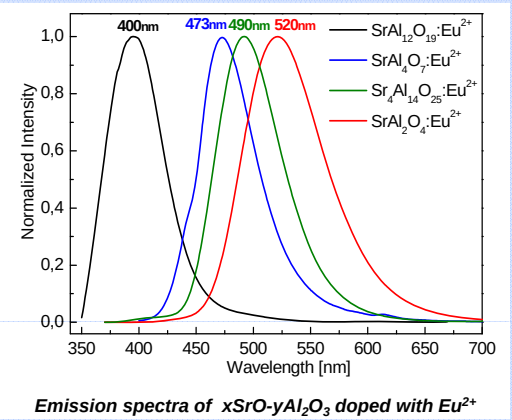
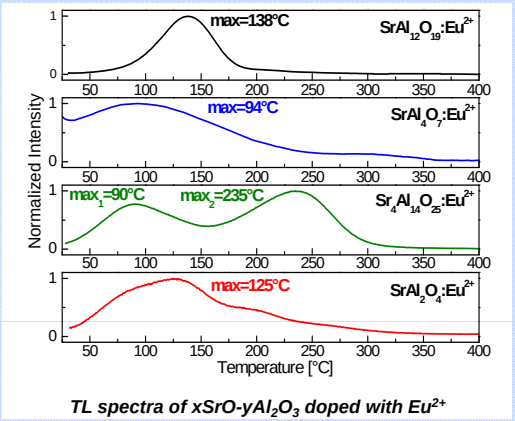
Introduction

In recent years afterglow phosphors have attracted considerable attention due to their potential applications in various fields, including emergency signs, light sources, luminous paint or optical data storage [1]. At the beginning of the 20th century the ZnS:Cu phosphor were developed as a long afterglow pigment. In the last 20 years, research on persistent luminescent phosphors has been switched strongly to aluminates doped with rare earth ions, which show a much brighter and longer afterglow [2].

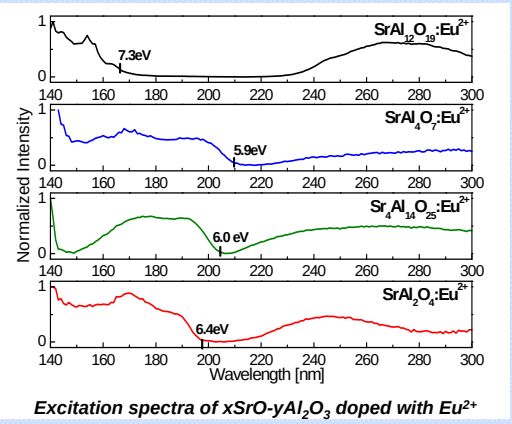
This work deals with persistent luminescence and thermoluminescence of Eu^{2+} in different strontium aluminate hosts, such as $SrAl_2O_4$, $SrAl_4O_7$, $SrAl_{12}O_{19}$, $Sr_4Al_{14}O_{25}$. All persistent phosphors were synthesized by conventional high temperature solid-state or combustion method under a reducing atmosphere. The photoluminescence (PL) and thermally stimulated luminescence (TSL) were recorded to characterize the type, intensity and duration of the afterglow .



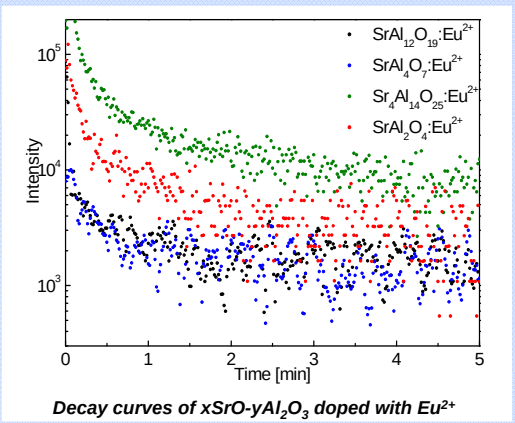
Emission spectra of $xSrO\text{-}yAl_2O_3$ doped with Eu^{2+}



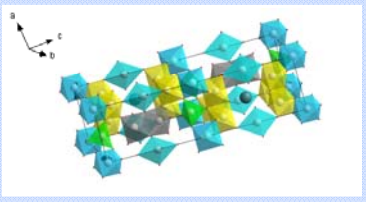
TL spectra of $xSrO\text{-}yAl_2O_3$ doped with Eu^{2+}



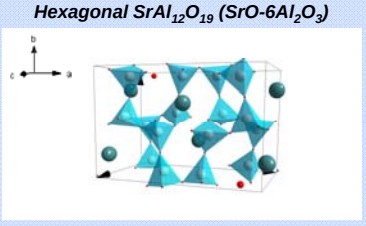
Excitation spectra of $xSrO\text{-}yAl_2O_3$ doped with Eu^{2+}



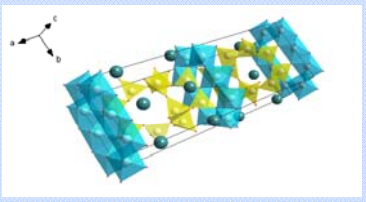
Decay curves of $xSrO\text{-}yAl_2O_3$ doped with Eu^{2+}



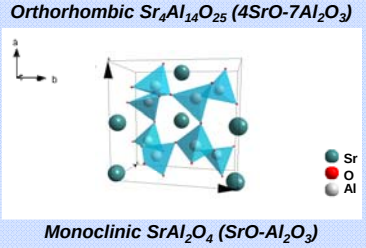
Hexagonal $SrAl_{12}O_{19}$ ($SrO\text{-}6Al_2O_3$)



Monoclinic $SrAl_4O_7$ ($SrO\text{-}2Al_2O_3$)



Orthorhombic $Sr_4Al_{14}O_{25}$ ($4SrO\text{-}7Al_2O_3$)



Monoclinic $SrAl_2O_4$ ($SrO\text{-}Al_2O_3$)

Conclusions

It was found that the emission of Eu^{2+} ions varies from the blue to the green depending on the host lattice due to crystal-field splitting and covalent interaction with the surrounding Oxygen anions.

Bright and persistent afterglow at room temperature was only observed for $SrAl_2O_4$ and $Sr_4Al_{14}O_{25}$ phosphors doped with Eu^{2+}, while Eu2+ doped $SrAl_{12}O_{19}$ and $SrAl_4O_7$ show rather weak afterglow.

TL measurements showed that $SrAl_{12}O_{19}$:Eu and $SrAl_4O_7$:Eu show solely a single glow peak at 138 and 94 °C, respectively. In contrast to that, the more alkaline strontium aluminates exhibit two glow peaks, viz. at 90 and 235 °C for $Sr_4Al_{14}O_{25}$:Eu and at 125 and 200 °C for $SrAl_2O_4$:Eu. We attribute these high temperature glow peaks to the strong afterglow at room temperature.

[1] Sang-Do Han, Krishan C. Singh, Tai-Yeon Cho, Jihye Gwak, Journal of Luminescence **2008** 128 301-305,
[2] Yuanhua Lin, Zilong Tang, Zhongtai Zang Materials Letters **2001** 51 14-18.