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 therloluminescence of Eu$^{2+}$ in different strontium aluminate hosts, such as SrAl$_2$O$_4$, SrAl$_4$O$_7$, SrAl$_{12}$O$_{19}$, Sr$_4$Al$_{14}$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.

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$_2$O$_4$ and Sr$_4$Al$_{14}$O$_{25}$ phosphors doped with Eu$^{2+}$; while Eu$^{2+}$ doped SrAl$_{12}$O$_{19}$ and SrAl$_4$O$_7$ show rather weak afterglow.

TL measurements showed that SrAl$_2$O$_4$:Eu and SrAl$_4$O$_7$: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$_4$Al$_{14}$O$_{25}$:Eu and at 125 and 200 °C for SrAl$_2$O$_4$:Eu. We attribute these high temperature glow peaks to the strong afterglow at room temperature.