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ies, Ed. Di Bartolo . 103. THE LUMINESCENCE OF EU2+ IN CaF, CRYSTAL

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It is found that two different luminescent Eu^{2+} centers exist in CaF_2 : Eu^{2+} crystal. The crystal color and luminescent stability are described.

1. INTRODUCTION

The luminescence of RE ions in ${\rm CaF}_2$ crystal has been studied extensively during the past few years $^{1-2}$, but few papers on the luminescence of ${\rm Bu}^{2+}$ in ${\rm CaF}_2$ crystal have been found. In this paper, we report the luminescence of the ${\rm Eu}^{2+}$ ions in ${\rm Eu}^{2+}$ -implanted ${\rm CaF}_2$ crystal and discuss the crystal color and luminescent stability which connect with the presentation of two luminescent centers of the ${\rm Eu}^{2+}$ ions.

2, EXPERIMENTAL

The experimental techniques were described in Ref. 6.

3, RESULTS AND DISCUSSION

We observed the luminescence of europium ions which were implanted into the CaF, crystal with dose of 1×10^{15} cm⁻¹ and energy of 100kV. The emission spectrum shows that the Eu²⁺ emission consists of two emission bands (see Fig. 1), one is around 420nm and the other around 680nm. We can conclude certainly that the two emission bands of Eu2+ are not caused by the same Eu2+ luminescent center, according to the differences of the excitation spectrum (see Fig. 2). The emission band around 420nm is due to the Eu²⁺ which replaces the Ca^{2+} lattice site, this was verified by the Eu^{2+} luminescence in CaF_2 : Eu^{2+} doped during growing up⁵. The emission around 680nm is due to the Eu $^{2+}$ which is situated in the interstice of the CaF, crystal lattice. Fig. 1 also shows the emission spectrum of the

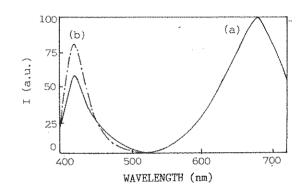


FIGURE 1 Emission spectra of CaF₂:Eu²⁺ at RT (a) Before annealing

(b) After annealing in vaccum $(7X10^{-5} \text{ torr})$ at 600°C for 30 minutes.

 ${\rm Eu}^{2+}$ -implanted ${\rm CaF}_2$ after annealing in vaccum $(7{\rm X}10^{-5}~{\rm torr})$ at 600 $^{\rm O}{\rm C}$ for 30 minutes. It is shown that the emission band around 680nm decreases remarkably, even disappears. This means that the ${\rm Eu}^{2+}$ in interstice of the ${\rm CaF}_2$ crystal lattice has migrated into the ${\rm Ca}^{2+}$ lattice site.

The implantation of ${\rm Eu}^{2+}$ makes the ${\rm CaF}_2$ crystal colored, so the crystal presents a very weak color of pink. The perfect crystal is damaged by the implantation process. The measurement of longitudinal optical phonon line in Raman spectrum may show the changes of the crystal symmetry. In our experiment, we measured the ${\rm CaF}_2$ LO-phonon line before and after the implantation, this means that the crystal symmetry is damaged. The color of ${\rm Eu}^{2+}$

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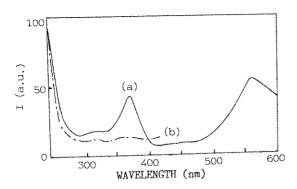


FIGURE 2 Excitation spectra of CaF_2 : Eu^{2^+} at RT (a) 680rm emission

(b) 420rm emission

-implanted ${\rm CaF}_2$ shows the influence of the crystal field or environment on the ${\rm Eu}^{2+}$ in the interstice of the ${\rm CaF}_2$ crystal lattice. The peak of the longer wavelength absorption band of the ${\rm Eu}^{2+}$ -implanted ${\rm CaF}_2$ crystal is in the visible region (peak at 580mm) which corresponds

to the color condition. Similarly, after annealing in vaccum at $600^{\circ}\mathrm{C}$ for a shorter-time, the color of the sample disappears, this means that the luminescence of the Eu²⁺ in the interstice of the CaF₂ crystal lattice is instable.

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