The synthesis and characteristics study of radiation phosphors using solution-combustion

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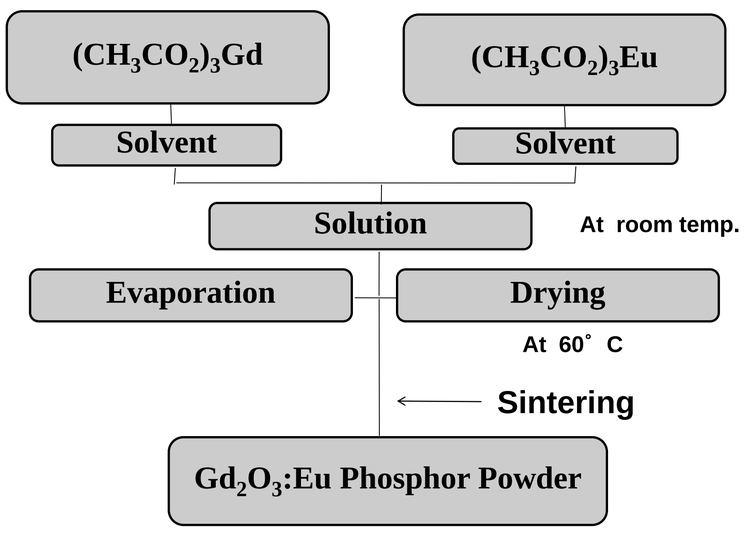
INTRODUCTION

For Indirect x-ray imaging sensor, phosphor materials with high resolution and high efficiency have been researched. A lot of radiation imaging system have been using phosphor in diagnostic field as a receptor material of x-ray. There are myriad characteristics according to a part of body and equipment. However, low conversion efficiency (about 5%) of $CaWO_4$ has been issued. In order to solve this problem, Gd_2O_2S:Tb, La_2O_2S:Tb, Lu_2O_3:Tb, and Y_2O_2S:Tb have been researched as a new alternative phosphors. Such rare earth phosphors are fabricated with bulk structure but have problems as conversion device like low resolution and low efficiency. As one of the solution to overcome these problems, nano-sized phosphor have been proposed and researched. In this paper, the properties of Gd_2O_3:Eu^{3+} and Y_2O_3:Eu nano phosphor according to Europium(Eu) density, calcinations temperature and calcinations atmosphere were investigated to improve their optical properties. Characteristic variations of synthesized fine phosphor with the activator doping ratio of 3, 5, 10 wt%, Eu in phosphor host, Gd_2O_3 and 8, 10, 15 wt%, Eu in phosphor host, Y_2O_3 with low temperature solution-combustion method were investigated.

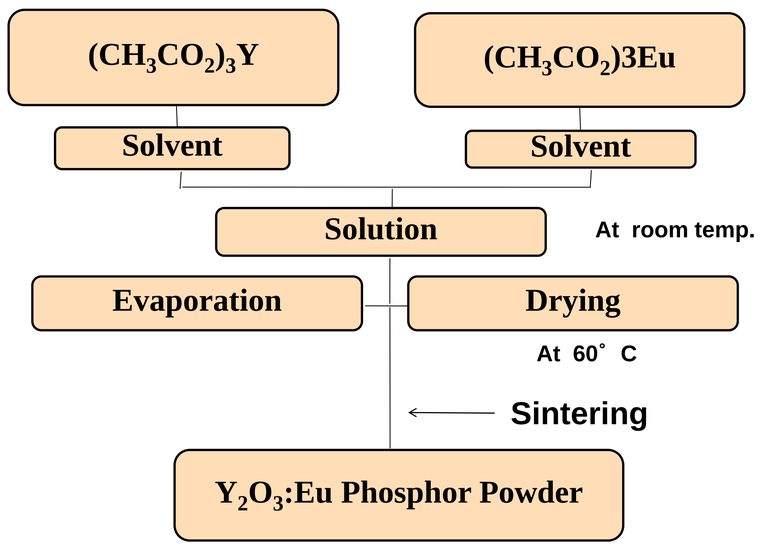
EXPERIMENTAL PROCEDURE

These are various synthesis methods in the nano phosphor fabrication. However, in this paper, nano powders of Gd_2O_3:Eu^{3+} and Y_2O_3:Eu were synthesized using a solution-combustion method. The properties of synthesized phosphors were measured by using X-ray diffraction (XRD), Field-emission scanning electron microscopy(FE-SEM), and Photoluminescence spectroscopy.

Method of Gd_2O_3:Eu Phosphor Powder



Method of Y_2O_3:Eu Phosphor Powder



RESULT & DISCUSSION

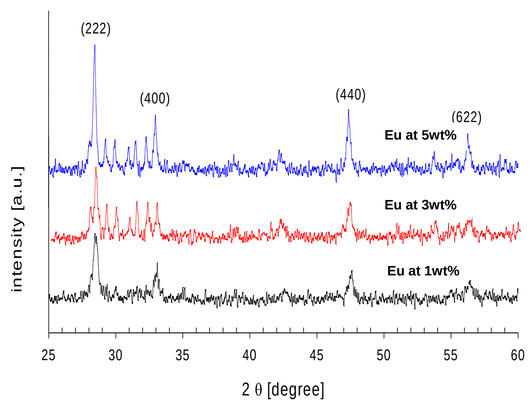


Fig. 1. X-ray Diffraction spectrum of Gd_2O_3:Eu fine phosphor

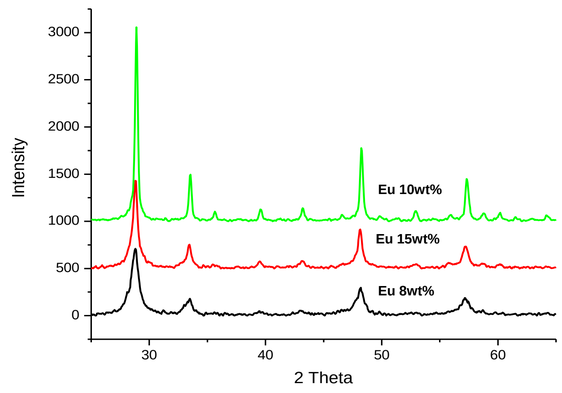


Fig. 2. X-ray Diffraction spectrum of Y_2O_3:Eu fine phosphor

Gd_2O_3:Eu and Y_2O_3:Eu of the XRD curve showed the phosphors were calcinated and cubic phase. As temperature increase, there is tendency to be cubic-phase.

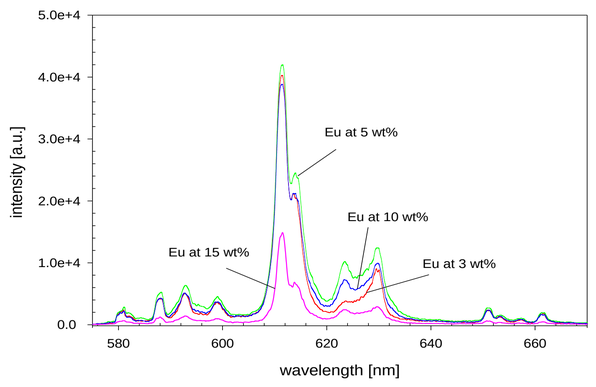


Fig. 3. PL spectrum of Gd_2O_3:Eu fine phosphor

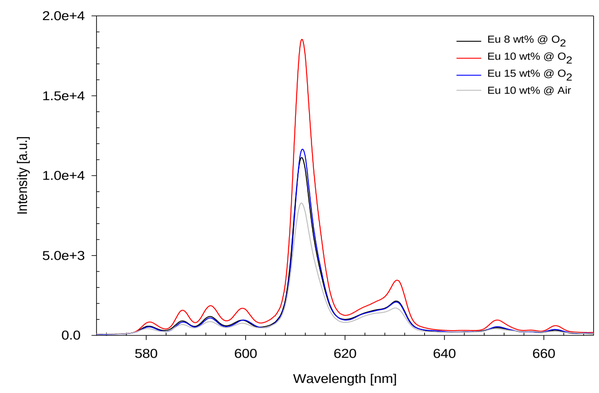


Fig. 4. PL spectrum of Y_2O_3:Eu fine phosphor

From optical property results, the strongest intensity of light was emitted at 611nm and emission peak was same to commercial bulk phosphor. The strongest luminescent intensity was achieved at 5wt% of Eu in Gd_2O_3 and 10wt% of Eu in Y_2O_3.

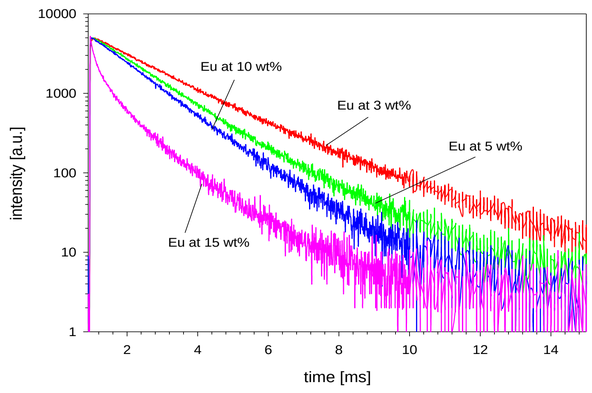


Fig. 5. Decay time of Gd_2O_3:Eu fine phosphor

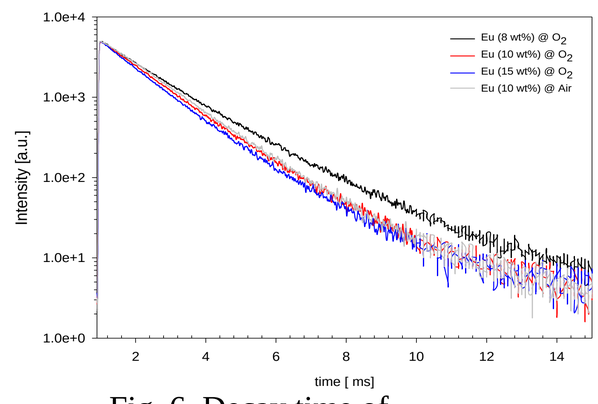


Fig. 6. Decay time of Y_2O_3:Eu fine phosphor

The result showed that fewer Eu was contained, longer decay time was measured. The nano phosphor had longer than decay time conventional bulk phosphor decay time.

CONCLUSION

Though fabricated nano phosphor showed longer decay time that conventional bulk phosphor, the efficiency of phosphor was improved.

From the study, it is that fabricated nano phosphor by solution-combustion method would show superior resolution by reducing blurring effect.

ACKNOWLEDGEMENT

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