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Wavelength discrimination of Composite ceramic YAG scintillator

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I. INTRODUCTION

In this abstract, we proposed a new kind of composite YAG crystal of which half is with Ce doped while the other half without, as shown in Figure 1. Emission peak wavelengths of Ce-doped and nondoped YAG were 525 and 300 nm, respectively as shown in Figure 2. Through identifying the wavelength of the scintillation light, it is possible to estimate in which part of the crystal the interaction happens. Experiment has been carried out to identify the idea mentioned above.

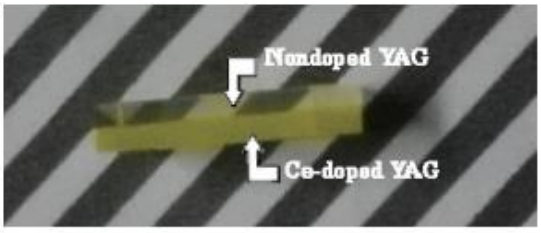

Fig. 1: Composite YAG crystal

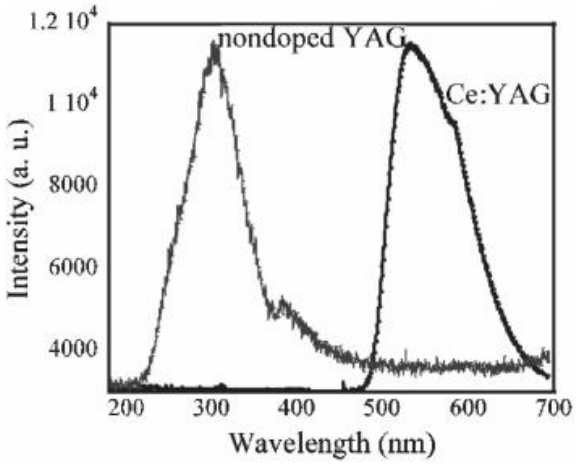

Fig. 1: Light wavelength from different part of the crystal

II. EXPERIMENTS AND ANALYSIS

A. *Experimental setup*

Figure 3 shows the setup of the experiment. Two Silicon Photomultipliers (SiPMs, KETEK PM6660) were employed to collect the scintillation light emitted from the crystal. There is a light filter (FUJI Light filter, 480 SC) between the crystal and SiPM in the left hand side in figure 3. Only light whose wavelength is longer than 480 nm can pass through this filter. As a result, when the interaction happens in the doped side, the light can pass through the filter, the two SiPM can collect a same amount of lights which results in the same amplitude of signal. However, when the interaction happens in the Nondoped side, the light cannot pass through the filter, therefore the signal of the right SiPM would be larger than the left one.

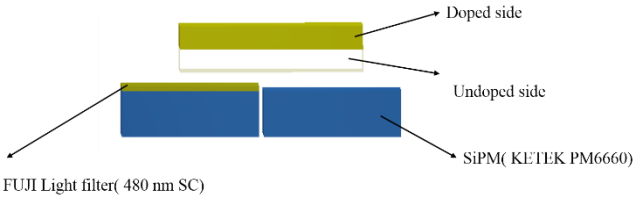

Fig. 3: Experimental setup

B. *Experimental result with a ^{137}Cs source*

A ^{137}Cs source was collimated and the Gamma ray was incident to the top center of the doped side crystal. Because the crystal is very thin(1mm doped and 1mm nondoped), so the Gamma-ray can easily penetrate the crystal. Therefore, interaction can happen at both side of the crystal. The signals from the two SiPMs are recorded and compared as figure 4 shows.

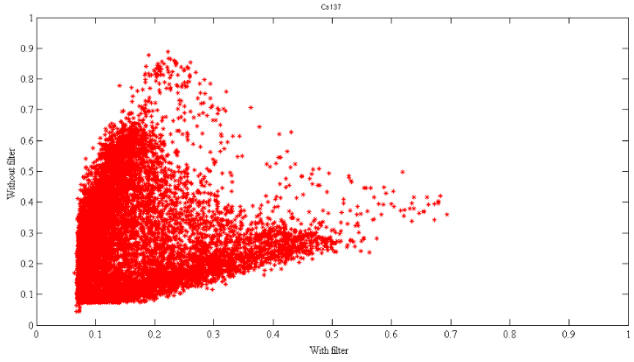

Fig. 3: Experimental result using a ^{137}Cs source

From the result, we can see that, two slopes were obtained which can be used to discriminate the interaction part of the crystal.

III. CONCLUSION

A new kind of composite YAG crystal is proposed in this abstract. This crystal is with two parts, half with Ce doped and half without. It is possible to estimate in which part the interaction happens through the difference of the wavelength of the lights emitter from the crystal.