Deep UV microscopy using two-photon excitation at 400 nm for 3D imaging of wide-gap semiconductor

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1. Introduction

In two-photon microscopy, long-wavelength light which has small absorption for semiconductor crystals can be used. As two-photon excitation is generated at the area that has plentifully high light intensity, it occurs only in the vicinity of focal point. Therefore, excitation light isn’t absorbed around the surface of crystal and reach inside. That makes it possible to observe the inside of the crystal. Also, we can make three-dimensional observation by scanning the focal point three dimensionally. For conventional two-photon fluorescence microscope, light which has wavelength of 800 nm has been ever used. In our study, we used the light which has wavelength of 400 nm as excitation light. That results in capability of observation of semiconductor crystals that have wider bandgap.

2. Experiment

Figure 1 shows the schematic of the optical system of a two-photon microscope using excitation light with a wavelength of 400 nm. The femtosecond laser with a wavelength of 800 nm is converted to a wavelength of 400 nm by SHG. YAP:Ce was chosen as a sample. This sample emits the fluorescence whose wavelength is 360-370 nm [1]. Figure 2 shows emission spectrum of YAP:Ce. The wavelength of excitation light is 410 nm. This spectrum has a peak at 365 nm. This peak wavelength is in good agreement with previous result [1]. The fluorescence of this wavelength isn’t able to be excited in one-photon process. This indicates that two-photon excitation with 400 nm light was successfully performed.

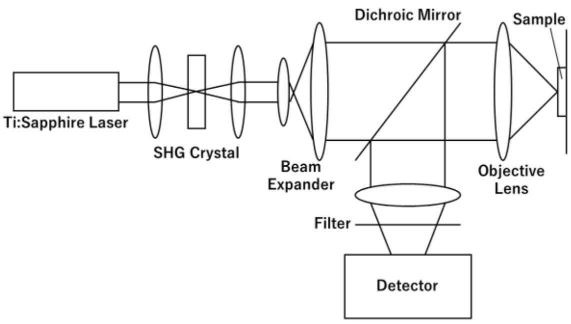

Figure 1 : Two-photon microscope using excitation light with a wavelength of 400 nm

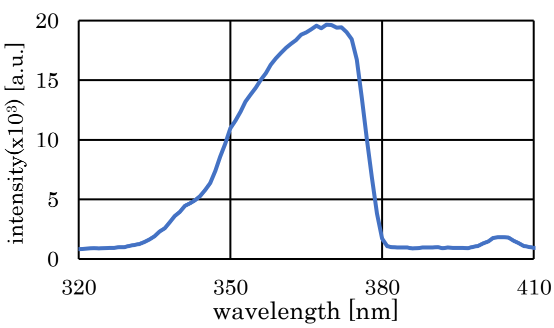

Figure 2 : Emission spectrum of YAP:Ce

Reference;
[1] Miroslav Mashlan, Hyperfine Interactions, Vol.139, p673 (2002)