Optical Properties of Micro-Diamond using Hard X-ray nanoprobe

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In recent years, diamond materials are the potential quantum optical materials, due to many kinds of defects and color centers existing in the wide bandgap diamond materials, such as nitrogen-vacancy (NV), Silicon vacancy (SiV), and boron vacancy (BV)……etc. However, there were few reports studying the interaction between diamond materials and hard X-ray sources. Therefore, we utilized the multifunctional hard X-ray nanoprobe of the Taiwan photo source (TPS) 23A to study the emission properties of the micro-diamond. The optical properties can be detailed studied by using X-ray excited optical luminescence (XEOL) and XEOL mapping. The emission distribution of the micro-diamond with an emission wavelength at 665 nm is shown in Fig. 1(a). We found that the emission intensity will aggregate in the edge of the micro-diamond. Furthermore, we can focus on the local area of P1 to obtain the XEOL spectrum shown in Fig. 1(b). The NV^0 zero phonon line at 575nm and the wide photon sideband of the micro-diamond can be observed clearly. In addition, based on the advantage of tunable energy using a synchrotron source, the XEOL spectra at different energy from 5 keV to 13.5 keV are also measured. It shows that the highest emission intensity of the micro-diamond can be obtained by using X-ray energy at 5 keV. In summary, X-ray nanoprobe can perform the spatial resolution to study the emission distribution of the micro-diamond. It is anticipated that the X-ray nanoprobe will open new avenues with great characterization ability for diamond-related materials.

Figure 1

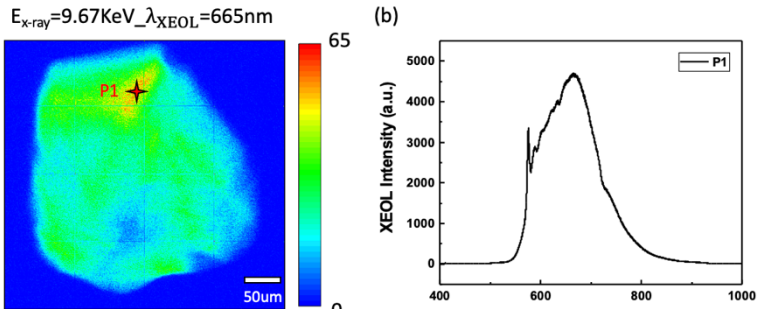

Figure 1 (a) shows the XEOL mapping of micro-diamond at XEOL peak of 665nm ,and (b) shows the XEOL spectra at point 1 on the micro-diamond(red point from fig 1(a)).

Keywords: X-ray Nanoprobe, XEOL, Nitrogen Vacancy

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