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The capabilities of X-ray excited optical luminescence by using X-ray nanoprobe beamline aimed for 40 nm spatial resolution at Taiwan photon source

Bi-Hsuan Lin

National Synchrotron Radiation Research Center, Taiwan

X-ray excited optical luminescence (XEOL) and time-resolved XEOL as well as the 40 nm spatial resolution which is focused by Montel KB mirrors are developed in the X-ray nanoprobe beamline at the new synchrotron facility, Taiwan Photon Source (TPS). Photoluminescence (PL) is one of the efficient and fundamental tools for characterising the optical properties of the wide band gap semiconductor materials. The advantages of using synchrotron radiation as the excitation source are that the tunable X-ray energy allows the preferential excitation of the elements through the X-ray absorption edges, and a suitable time structure of the synchrotron can be used to study the dynamics of luminescence of the materials. Before the nanoprobe beamline constructing completion, the XEOL experiment was measured by unfocus X-ray beam at Taiwan Light Source (TLS). In this study, by means of XEOL to study the optical properties of O and Zn polarity of c-plane ZnO bulks has been achieved successfully. The low temperature (less than 5K) and temperature-dependent XEOL with X-ray excited energy below, at and above the Zn K-edge (9.659keV) were used to obtain the further information of the optical mechanisms of the two polar faces. The first excited state ($n=2$) of A free exciton was observed at 3.422eV with only for O-polar. The result indicates that O-polar has higher optical quality than Zn-polar. The exciton-phonon (A1-LO) coupling strength will be changed by using different X-ray excitation energy while the temperature above 150 K. The current design of the nanoprobe beamline and the detail XEOL experimental results will be reported.

Biography

Bi-Hsuan Lin has completed his PhD from Department of Photonics and Institute of Electro-Optical Engineering, National Chiao Tung University, Hsinchu, Taiwan and Postdoctoral studies from European Synchrotron Radiation Facility (ESRF) for one year. Now, he works at National Synchrotron Radiation Research Center as the Assistant Scientist. He is participating in the construction and commission of the X-ray nanoprobe beamline at Taiwan Photon Source (TPS), and is responsible for development of the XEOL and TR-XEOL.

bihsuan@nsrrc.org.tw

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