The capabilities and current status of XEOL and TR-XEOL at X-ray Nanoprobe at Taiwan Photon Source

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We have developed successfully the synchrotron based X-ray excited optical luminescence (XEOL) and time-resolved X-ray excited optical luminescence (TR-XEOL) at the X-ray Nanoprobe (XNP) beamline at Taiwan Photon Source (TPS). Advanced by energy-tunable hard X-rays, the XNP at TPS provides 40 nm spatially resolving means for investigating the optical properties of specific elements in the wide band gap semiconductor materials. An ultrafast streak camera is synchronized with the pulse structure of the synchrotron ring to study the dynamics of luminescence of the materials with temporal resolution 30 ps $\sim$ 1.72 μs. In parallel to the construction of the XNP endstation, demonstrative XEOL experiments were conducted by unfocused X-ray beam at Taiwan Light Source (TLS). Polarization-dependent XEOL was used to study not only the optical properties but also the crystallographic orientations of a non-polar *a*-plane ZnO wafer. Besides, a positive-edge jump and extra oscillations in the near-band-edge (NBE) XEOL yield, we also observed a blue shift of the NBE emission peak that follows the polarization-dependent X-ray absorption near-edge structure (XANES) as the X-ray energy is tuned across the Zn K-edge. The results show that the crystallographic orientations of *a*-plane ZnO wafer can be determined by using polarization-dependent XEOL spectra. The detail design of the XEOL and TR-XEOL at XNP and the demonstrative experimental results will be reported.