

Anomalous emission of non-polar *a*-plane MgZnO epi-films studied by XEOL and time-resolved XEOL at TPS23A

Yu-Hao Wu^{2,1} (吳祐豪), Bi-Hsuan Lin^{1*} (林碧軒), Xiao-Yun Li¹ (李嘯灃), Wei-Rein Liu¹ (劉維仁), Shun-Yuan Hou^{4,1} (侯順淵), Chih-Hao Lee⁴ (李志浩), Mau-Tsu Tang¹ (湯茂竹) and Wen-Feng Hsieh³ (謝文峰)

¹ National Synchrotron Radiation Research Center, Hsinchu 30076, Taiwan

² Department of Materials Science and Engineering, National Chiao Tung University, Hsinchu 30010, Taiwan

³ Department of Photonics and Institute of Electro-Optical Engineering, National Chiao Tung University, Hsinchu 30010, Taiwan

⁴ Department of Engineering and System Science, National Tsing Hua University, Hsinchu 30076, Taiwan

bihsuan@nsrrc.org.tw

Abstract

Time-resolved X-ray excited optical luminescence (TR-XEOL) and X-ray excited optical luminescence (XEOL) at 23A X-ray Nanoprobe (XNP) beamline of the Taiwan Photon Source (TPS) were applied to study the emission properties of the non-polar *a*-plane MgZnO epi-films. According to our previous study, the emission of *a*-plane MgZnO epi-films was dramatically enhanced more than 20 times after X-ray irradiation[1]. Especially, we observed the anomalous emission at 325 nm, which conforms the emission of *r*-plane sapphire. We thought that the high energy of the X-ray nanobeam may give rise to the anomalous excitation and cause the charge transfer at the same time. The luminescence dynamic process was also measured by TR-XEOL operating in the hybrid bunch mode, which provided the advantages that high enough X-ray photon flux as well as longer time interval (30 ps ~ 220 ns)[2]. The lifetime of *a*-plane MgZnO decreased gradually with the X-ray irradiation time. Finally, we fitting the results to explain the different behaviors of phenomenon.

Keywords – XEOL · TR-XEOL · MgZnO epi-films

References

1. B.-H. Lin, Y.-H. Wu, T.-S. Wu, Y.-C. Wu, X.-Y. Li, W.-R. Liu, M.-T. Tang, and W.-F. J. A. P. L. Hsieh, *Applied Physics Letters* **115**, 171903 (2019).
2. B.-H. Lin, Y.-H. Wu, X.-Y. Li, H.-C. Hsu, Y.-C. Chiu, M.-T. Tang, and W.-F. J. J. o. S. R. Hsieh, *Journal of Synchrotron Radiation* **27** (2020).