Excitonic emission in β-TlInS2

Raul Paucar[1], Kazuki Wakita*[1], YongGu Shim[2], Oktay Alekperov[3] and Nazim Mamedov[3]

[1] Chiba Institute of Technology , 2-17-1 Tsudanuma, Narashino, Chiba 275-0016, Japan

[2]Osaka Prefecture University, 1-1 Gakuen-cho, Naka-ku, Sakai 599-8531, Japan

[3]Institute of Physics, Azerbaijan National Academy of Sciences, H. Javid ave. 33, Baku AZ-1143, Azerbaijan

*E-mail: kazuki.wakita@it-chiba.ac.jp

Quasi-two-dimensional ternary thallium dichalcogenide $TlInS_2$ is well known as a layered semiconductor with interesting electrical, opticals, and structural properties which show potential for optoelectronic applications [1]. It has been established that, on cooling, $TlInS_2$ compounds exhibits a sequence of structural phase transitions from a paraelectric-normal (N) phase to a ferroelectric-commensurate (C) phase via an intermediate incommensurate (I) phase. However, despite the fact that a large number of investigations have studies the physical properties of layered $TlInS_2$ crystals, the mechanisms which lead to the occurrence of these phase transitions is not completely clear, in part because of the existence of the different kind of polytypes [2]. In this work, photoluminescence (PL) spectrum at the band edge region in the β-$TlInS_2$ crystals measured using a confocal microscopy system were investigated over the temperature range 77- 300 K, which includes the range of the successive phase transitions.

Figure 1. shows the excitation power density dependence of the PL spectra at the band edge region at 77 K . The recorded spectra show a high intensity PL band between 2.4 and 2.6 eV. The band exhibits a slightly asymmetry Lorentzian line shape and the peak position shift towards low energies when increasing the laser excitation power from to 1350 W cm^{-2}. The spectra were resolved in two Lorentzian peaks (I and II) as shown in the inset. Based on the analysis of the excitation intensity dependence of the PL intensity emission [3], the peaks I and II were assigned to biextionic and exciton emissions, respectively. The detailed results and discussion will be presented at the conference.

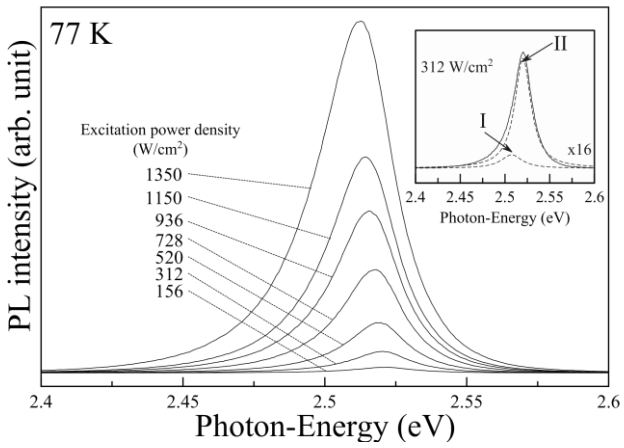

Fig. 1 Excitation power density dependence of PL spectra at the band edge region at 77 K.

[1] A. M. Panich, J. Phys.: Condens. Matter 20, 293202 (2008).
[2] O. Z. Alekperov, A. I. Nadjafov, Inorganic Materials 40, No. 12, 1248 (2004)
[3] J. I. Pankove, Optical Processes in Semiconductors. Dover Publications, Inc., 1975.

Acknowledgements
This is work was supported in part by the Ministry of Education, Culture, Sport, Science and technology, Japan, through a Grant-in-Aid (No. 26420278).