P25

Design and fabrication of THz torch device containing Ga(As,Bi)/AlGaAs parabolic quantum well in active region for THz emission

Mindaugas Karaliūnas[1], Justas Pagalys[1], Vytautas Jakštas[1], Jan Devenson[1], Simona Pūkienė[1], Renata Butkutė[1], Andres Udal[2], and Gintaras Valušis[1]

[1]*Optoelectronics department, Center for Physical Sciences and Technology, Sauletekio Av. 3, 10257 Vilnius, Lithuania*

[2]*Department of Software Science, Tallinn University of Technology, Ehitajate tee 5, 19086 Tallinn, Estonia*

Email: mindaugas.karaliunas@ftmc.lt

Terahertz (THz) waves are unique for its properties to penetrate through most of opaque dielectric materials and read out chemical composition of covered substances without affecting the content [1]. For many applications, such as security, defense, telecommunication, non-destructive quality inspection, etc., fast, reliable, compact and easy-to-operate THz spectroscopy and imaging systems are required. While there are some achievements in compact highly-sensitive detectors [2] and compact functional optic elements [3] the efficient room-temperature emitters remains main obstacle for introduction of cost-effective, robust and application-ready system. The aim of this work is to demonstrate the newly designed incoherent THz source – THz torch – with parabolic quantum well (PQW) in the active region which serves as an artificial transition pathway for carriers that meet THz frequency to enhance the radiation at the spectral range of interest.

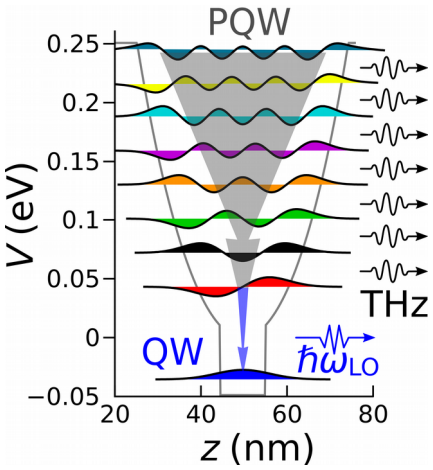

Fig. 1. Arrangement of PQW subbands in active region of THz torch device with LO phonon scattering depopulation.

The new device concept is proposed to increase the power of THz radiation by depopulating the lowest subband of PQW with LO phonon scattering as it is shown in Fig. 1. The analog graded Ga(As,Bi)/AlGaAs PQW samples were grown using molecular beam epitaxy technique [4]. The two terminal *pin* diode THz torch device is designed and fabricated.

ACKNOWLEDGMENT

This research has received funding from European Social Fund (project No 09.3.3-LMT-K-712-02-0172) under grant agreement with the Research Council of Lithuania (LMTLT).

REFERENCES

[1] M. Karaliūnas, K. E. Nasser, A. Urbanowicz, I. Kašalynas, D. Bražinskienė, S. Asadauskas and G. Valušis; *Scientific Reports* **8** 18025 (2018).

[2] V. Jakštas, J. Jorudas, V. Janonis, L. Minkevičius, I. Kašalynas, P. Prystawko and M. Leszczynski; *Lithuanian Journal of Physics* **58**(2), (2018) pp 188-193.

[3] D. Jokubauskis, L. Minkevičius, M. Karaliūnas, S. Indrašiūnas, I. Kašalynas, G. Račiukaitis and G. Valušis; *Optics Letters* **43**(12), 2795 (2018).

[4] S. Pūkienė, M. Karaliūnas, A. Jasinskas, E. Dudutienė, B. Čechavičius, J. Devenson, R. Butkutė, A. Udal and G. Valušis; *Nanotechnology* **30** 455001 (2019).