QUANTUM WELL INFRARED PHOTODETECTOR OPERATING AT ROOM TEMPERATURE

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In today's quickly technologically emerging world infrared frequency range sensing systems are becoming more and more attractive for versatile applications like security, healthcare, agricultural industry etc. [1, 2]. Quantum well infrared photodetectors (QWIP) first demonstrated detector types for such sensing systems due to its economic efficiency and relatively simple manufacturing process [3]. Up to now the majority of applications, require cryogenic QWIP cooling in order to cancel out the room temperature background and obtain reasonable sensitivity and response time [4]. In the current study less cooling-dependent QWIP of the 7-12 μm wavelength range to (atmospheric window) were developed to respond to the high demand of infrared detectors for specific gas sensing [5]. In this work, the properties of GaAs/AlGaAs QWIP detectors designed and built using the FTMC facilities for 8-9 μm wavelength detection range are investigated. Characterization at room temperature as well as at the temperatures below 100 K was performed by measuring electrical properties and acquiring infrared photoresponse spectra in order to estimate signal to noise ratio and spectral responsivity.

Spectra were obtained using conventional infrared Fourier spectroscopy. The collimated radiation emanating from the spectrometer was focused by a parabolic mirror (*f* = 5 cm) onto a surface of the QWIP. It was placed on the cold finger in the cryostat and biased with the DC voltage. Photo response was measured by using the Lock`in technique, mechanically chopping output radiation at 211 Hz. Spectra obtained with QWIPS having different grating couplers on top are presented in Fig. 1 (bottom). Each spectrum is smoothed and shifted by constant value in horizontal axis for easier comparison.

The obtained results give an opportunity for the development of room temperature QWIPs which in turn opens possibilities for compact and light-weight sensing systems to be developed and used in wide amount of practical applications.

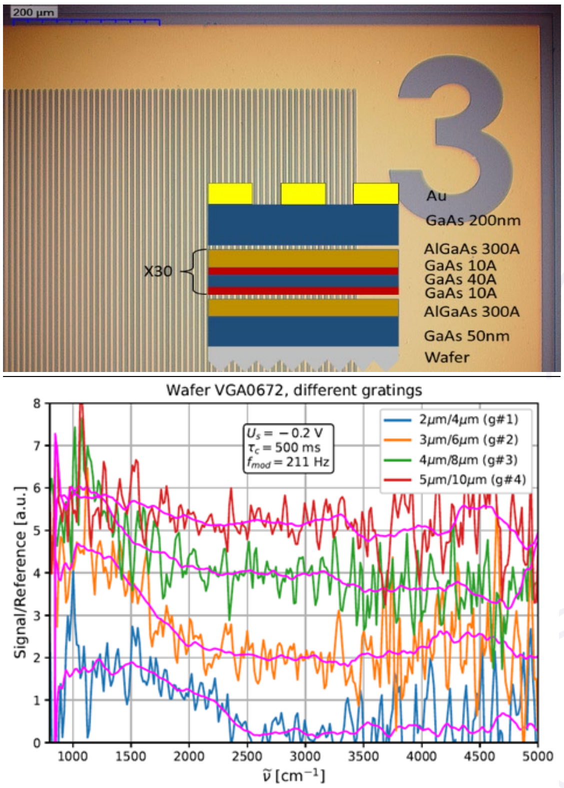

Fig. 1. The photo of the part of QWIP detector and its schematic cross section (top). Spectra obtained at room temperature (bottom).

References

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