

MEASUREMENTS OF HIGH FREQUENCY PARAMETERS OF MICROWAVE DIODES IN K_A FREQUENCY RANGE USING AUTOMATED PROBE STATION SETUP

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In order to use microwaves, we need to have electromagnetic radiation detectors, which can sense high frequency signals even at lowpower levels. The detection of microwave radiation is obtained using non-linear elements, mainly diodes - two-terminal electronic components that can conduct current in one direction better than in another. Today semiconductor diode structures are most commonly used for electromagnetic detection. Most widespread Schottky junction-based [1] or planar doped-barrier diodes (PDB) [2] have found applications for microwave measurements. However, complexity of these electronic devices encourages scientific and engineering community to pursue new original design of microwave diodes sensing short pulses of microwave radiation and being cost effective at the same time [3]. Microwave and millimeter wavelength range requires certain specifications for electromagnetic detectors: the voltage sensitivity (thus the detected voltage also) should not depend on frequency, the detectors must be both reliable and sensitive to the impact of electromagnetic radiation. Investigation of high frequency detection properties of different semiconductor structures and design of electromagnetic radiation detectors are two inseparable subjects that are quite a hot issue in modern microwave electronics area. High frequency parameters of the microwave diodes, such as detected voltage, are usually investigated by mounting single diode into microwave waveguide transmission line [4]. However, that is rather complicated and time-consuming process. These measurements can be achieved using high frequency probe station, which allows to perform detected voltage and voltage sensitivity measurements. This measurement approach can both save time and exclude the possibility of diode damaging during the diode mounting process, because the measurements are made right onto semiconductor substrate, without dividing it into single diodes. In this paper, we present the developed automated high frequency probe station measurement setup for obtaining voltage-power characteristics of microwave diodes.

In order to test the measurement setup and determine the quality of the results, the detection properties of GaAs/AlGaAs heterojunction diodes were measured using the developed setup and also by mounting them into a waveguide head's micro-strip line where TEM wave propagates (fin-line adapter connects it to a waveguide transmission line). The results showed that the diodes are capable to detect electromagnetic radiation in the measured frequency range. The comparison of experimental results, obtained by using different measurement methods, showed that using the developed high frequency probe station setup while measuring detection sensitivity of microwave diode on a polyimide film in Ka frequency range gives truly reliable results, although further improvements can be made for better quality of the experiment.

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