

Highly sensitive detector of electromagnetic radiation

Background

A common method of detecting electromagnetic radiation is based on the internal photoelectric effect in a solid-state device, in particular in a semiconductor structure. Such detectors are able to register small changes of a dc current or voltage induced in the device by the incident electromagnetic radiation. A crucial parameter of such devices is their sensitivity to the irradiation. The object of the invention is to provide a detector of electromagnetic radiation with an improved sensitivity.

Highly sensitive detectors capable of detecting electromagnetic radiation in the microwave, terahertz and infrared frequency range can be used in many different areas, including security, medicine, chemical and biological agent detection, material characterization, THz imaging, telecommunication, astronomy and other fields.

Invention

The detector according to the invention is based on a semiconductor heterostructure with source, drain and gate contacts. The gate contact operates as a quantum point contact (QPC). A substantially enhanced sensitivity of the device to electromagnetic radiation is achieved through the use of a special shape of the gate QPC which is formed as a bridged gate (in contrast to conventional split-gate QPCs).

Based on this specially designed gate contact the internal responsivity of the detector could be estimated to be about 10^6 V/W at millimeter wave frequencies and 4.2 K. This is several orders of magnitude larger than the responsivity of typical Schottky-diode detectors. A further enhancement of the responsivity could be realized by using graphene related materials.

The detecting method is able to work in a broad frequency range, from microwave up to infrared frequencies.

Commercial opportunities

The invented detector can be applied in all areas where a highly sensitive detection of electromagnetic radiation is required. Therefore there is a large scope of application that extends to security (scanning of luggage and persons), medicine (early diagnosis of cancer and other illnesses), materials testing (quality control), communication (high bandwidth data transmission) and electromagnetic imaging in general.

Developmental status

The idea and specific designs are developed. First experiments have been carried out. The development of a prototype is planned for the near future.

Origin

University of Augsburg

Industrial sector(s)

Security:

Full body scanner (airport, police, post, banks)

Chemical and pharmaceutical industry:

Spectroscopic analysis of organic molecules

Medicine:

Detection of epithelial cancer

Materials science:

non-destructive materials testing, quality control

Communication:

High-altitude telecommunications, wireless data transmission with high bandwidth

Spaceflight:

Measuring and communication systems

Keywords

Terahertz radiation, detection of electromagnetic radiation, highly sensitive, imaging, quantum point contact (QPC), bridged gate structure

Patent situation

PCT patent application filed

Offer

Cooperation, license, transfer of patent rights

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