Gate-mediated helicity sensitive detectors of terahertz radiation with graphene-based field effect transistors

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Abstract

Closing of the so-called terahertz gap results in an increased demand for optoelectronic devices operating in the frequency range from 0.1 to 10 THz. Active plasmonic in field effect devices based on high-mobility two-dimensional electron gas (2DEG) opens up opportunities for creation of on-chip spectrum [1] and polarization [2] analysers. Here we show that single layer graphene (SLG) grown using CVD method can be used for an all-electric helicity sensitive polarization broad analyser of THz radiation. All our results show plasmonic nature of response. Devices are made in a configuration of a field-effect transistor (FET) with a graphene channel that has a length of 2 mkm and a width of 5.5 mkm. Response of opposite polarity to clockwise and anticlockwise polarized radiation is due to special antenna design (see Fig.1c) as follow works [2,3]. Our approaches can be extrapolated to other 2D materials and used as a tool to characterize plasmonic excitations in them.

References

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[3] Gorbenko, I. V., et al., physica status solidi (RRL)–Rapid Research Letters, 13(3), (2019), 1800464.

Figures

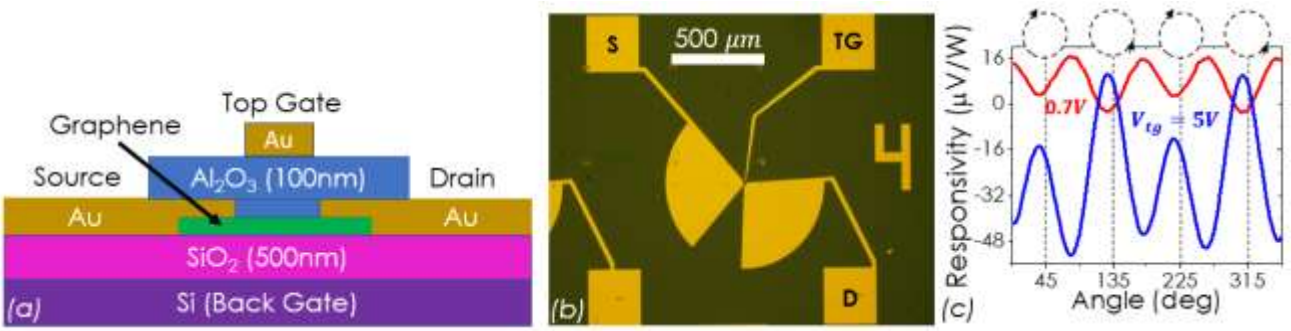

Figure 1: (a) *Schematic of the device showing relative location of the source, drain and top gate electrodes and thickness of the dielectric layers. (b) Optical image illustrating the device layout with source and drain electrodes* connected to sleeves of a bent bow-tie antenna. (c) Helicity dependence of the detector responsivity R at room temperature for λ = 118 μm with two different gate top voltages; 45 degree angle correspond clockwise circular polarized radiation, accordingly 135 degree angle correspond anticlockwise circular polarized radiation.