

Technology of graphene and related nanomaterials for THz application

Wednesday, 6 July 2022 17:35 (15)

Terahertz (THz) systems and technology have become of large interest over the last 20 years. However, it still needs new and innovative solutions in the field of both generation and detection of THz radiation. Despite the fact that scientists in many research centers are constantly working on the production of new THz sources and detectors based on semiconductors such as silicon, it turns out that carbon nanomaterials, including graphene and van der Waals heterostructures consisting of layered two-dimensional (2D) materials (h-BN or MoS₂) are extremely promising materials for amplification and emission of THz radiation. Also, combination of 2D materials with “classical” semiconductor materials like GaN and/or GaAs can lead to the production of materials with unprecedented THz properties.

We demonstrate different methods of manufacturing nanodevices based on graphene and other 2D related materials. These methods include both the fabrication of 2D heterostructures from the micrometer scale to large surface area materials. We present step-by-step how to combine 2D materials with different materials, e.g. semiconductors, and how to fabricate matrices of THz elements (detectors, metasurfaces).

A comprehensive characterization of the basic electric and THz properties of these materials will be also presented. Preliminary results and theoretical analysis indicate the great potential of graphene-based nanostructures for terahertz applications.

Acknowledgements

The work was supported by the “International Research Agendas” program of the Foundation for Polish Science co-financed by the European Union under the European Regional Development Fund (No. MAB/2018/9) for CENTERA. A.Krajewska was supported by the Foundation for Polish Science (FNP).

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Session Classification : Wed 06/07 Poster Session/ ID: