Photoelectromagnetic Investigations of Graphene

Marian Nowak [1], Barbara Solecka[1], Marcin Jesionek [1]

[1] *Solid State Physics Section, Institute of Physics - Center for Science and Education, Silesian University of Technology, Krasińskiego 8, 40-019 Katowice, Poland*

The photoelectromagnetic (PEM) investigations of graphene has been done using noncontact technique. In a graphene illuminated by a circular spot, free electrons and holes are photogenerated in a region from which they diffuse in all directions in the sheet. When a magnetic field is applied perpendicularly to the graphene surface, diffusing carriers are deflected owing to the Lorentz force and so-called PEM current flows. Under amplitude-modulated illumination of a sample the PEM circulating current varies, and consequently the changing magnetic flux, caused by it, can induce a measurable voltage in suitably placed pick-up coils. The investigated samples of graphene were supplied by Graphene Supermarket. Monolayer graphene films were grown by CVD processing on a cooper foil and transferred onto a Corning EAGLE XGTM AMLCD glass substrate. The dependence of PEM response on magnetic field induction, illumination intensity for different photon energies, and frequency of illumination chopping is presented. Fitting of the experimental results with theoretical dependences have allowed determination of carrier lifetimes. Mapping of the PEM response over the investigated sample is shown, too. We anticipate our paper to be a starting point for PEM investigations of minority carrier lifetime and carrier diffusion length in graphene. Such investigations should be essential for development of graphene electronic and optoelectronic devices.

This work was partially supported by the National Science Centre project no. DEC-2012/05/B/ST7/01198.