Transport coefficients of bilayer graphene

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Currently, scientists are paying great attention to the study of a new carbon material – graphene [1-2]. Determination of its transport properties and their dependence on external fields is one of the most pressing problems in the physics of low dimensional nanostructures.

In this paper, the semiclassical approximation of the relaxation time to obtain an expression for the current density and transport coefficients of two-layer graphene in the presence of an external electric field. Double-layer graphene consists of two graphite layers with a hexagonal structure. Between two layers of graphene attached electrostatic potential. The electronic structure of such a system is usually considered in the π-electrons in the nearet framework of tight-binding model for neighbors.

The dispersion relation for bilayer graphene is chosen in the form [3]. From the periodicity of the dispersion that can be represented as a Fourier series. In the semiclassical approximation of the electron distribution function is found from the Boltzmann equation in the τ-approximation. We can assume that the relaxation time experimentally established that in graphene even at temperatures of about 40 K, the relaxation time constant and does not depend on temperature.

Obtained by the method of theoretical calculation of transport coefficients of electrons of semiconducting single-walled carbon nanotubes in an electric field in the relaxation time approximation. Obtained analytically and numerically analyzed the expression for the diffusion of electrons and nonlinear electronic conductivity. Found nonlinear dependence of these factors on the field. When the diameter of CNTs these ratios are also increasing. It is shown that for strong fields, these ratios tend to saturation.

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