Nanocomposites and nanomaterials

Transmission spectra of the Dirac-Weyl electrons through the graphene-based superlattice with the Fermi velocity barriers

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The one-dimensional superlattice (SL) based on a monolayer graphene with the Fermi velocity barriers (see e.g. [1,2]) is considered. We assume that the rectangular barriers are arranged periodically along the 0x axis. The transmission spectra of the quasi-electrons through this SL are calculated with the help of the transfer matrix method in the continuum model.

In contrast to the case of other types of the graphene SL (e.g. [3,4]) spectra studied reveal the periodic character at the whole energy scale and the transmission coefficient doesn't tend asymptotically to unity at rather large energies.

Spectra demonstrate the rich variety of configurations (patterns) of the allowed and forbidden bands location and, for some special parameter values, they expose the regular character, symmetrical with respect to a certain point. The minimal period may be equal to the tenth of eV, but it may also be large - of order of several eV. Both the energy location of the bands and their width are very sensitive to the Fermi velocity magnitude as well as to other quantities: the external electrostatic potential and the geometrical parameters (width of barriers and quantum wells).

Varying the parameters of the system considered it is possible to change the spectra flexibly; so the results of this work may be useful for applications in the graphene-based electronics.

1. *Concha A., Tesanovic Z.* Effect of a velocity barrier on the ballistic transport of Dirac fermions // Physical Review B.-2010.-**82.**-P.033413-1 – 033413-4.

2. *Wang Y., Liu Y., Wang B.* Resonant tunneling and enhanced Goos-Hanchen shift in a graphene double velocity barrier structure // Physica E.-2013.-**53.**-P. 186-192.

3. *Korol A.N., Isai V.N.* Energy spectrum of the graphene-based Fibonacci superlattice // Physics of the solid state.-2013.-**55**.-P. 2596-2601.

4. *Korol A.N.* Transmission spectra of electrons through the Thue-Morse

graphene superlattice // Low Temperature Physics.-2014.-**40**.-P. 324-329.