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Ferromagnetic/graphene/ferroelectric nanostructures as a promising non-volatile spin filters and spin valves.

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We calculated [1] a spin-polarized conductance in the almost unexplored nanostructure “high temperature ferromagnetic insulator/ graphene/ ferroelectric film” with a special attention to the control of electric polarization direction and value in a multiaxial ferroelectric film by a misfit strain. We proposed a phenomenological model taking into account the shift of the Dirac point due to the proximity of ferromagnetic insulator and using the Landauer formula for the conductance of the graphene channel. We derived analytical expressions, which show that the strain-dependent ferroelectric polarization governs the concentration of two-dimensional charge carriers and Fermi level in graphene in a self-consistent way.
Due to essential spin asymmetry of the band spectrum of graphene channel, imposed by ferromagnetic, the obtained results demonstrate the realistic opportunity to control the spin-polarized conductance of graphene by a misfit strain at room and higher temperatures in the nanostructures CoFeO4/graphene/PZT and Y3Fe5O12/graphene/PZT, and so open the possibilities for the applications of ferromagnetic/graphene/ferroelectric nanostructures as non-volatile spin filters and spin valves.

[1]. Anna N. Morozovska, Eugene A.Eliseev, Maksym V.Strikha. Strain engineering of ferromagnet-graphene-ferroelectric nanostructures // Physical Review Applied. – 2020. - Vol. 14, No. 2. –article number 14.024081.

Topics

Session A. Physics of condensed matter and spectroscopy

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