Nanoscale physics

Temperature behavior of the conductance in the nano-structure "graphene channel - ferroelectric substrate with domain walls"

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Recently the thermodynamics and kinetics of the conductance of p-n junctions induced in graphene channel by stripe domains nucleation, motion and reversal in a ferroelectric substrate has been explored using self-consistent approach based on Landau-Ginzburg-Devonshire phenomenology combined with classical electrostatics, semiconductor theory and quantum statistics for electrotransport calculations [1-3]. This work explores peculiarities of the temperature behavior of the graphene channel conductance in the nano-structure "top gate/dielectric layer/graphene channel/ferroelectric substrate with domain structure" that is a basic element for FETs [Fig.1].

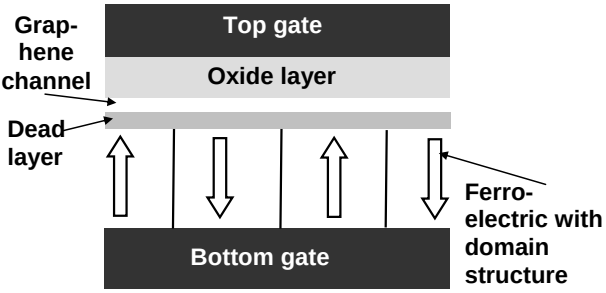

Figure 1. Schematics of the nano-structure "graphene channel - ferroelectric substrate with domain walls"

We revealed the nontrivial dependences of the conductance hysteresis on temperature and gate voltage amplitude, which exist in the vicinity of ferroelectric substrate Curie temperature and far from it. It appeared that the nontrivial peculiarities originate from the temperature evolution of the domain structure

kinetics in ferroelectric substrate. Since the domain walls structure, period and kinetics can be controlled by varying the temperature, we concluded that the considered nano-structures based on graphene-on-ferroelectric are promising for the fabrication of new generation of modulators based on the graphene p-n junctions.

1. A.N.Morozovska, E.A.Eliseev, and M.V.Strikha. Appl. Phys. Letters 108, 232902 (2016).
2. M.V.Strikha and A.N.Morozovska. J. Appl. Phys. **120**, 214101 (2016).
3. A. I. Kurchak, E. A. Eliseev, S. V. Kalinin, M. V. Strikha, A. N. Morozovska. (http://arxiv.org/abs/1703.06500)