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Electrical properties of heterointerfaces composed of complex ferroelectric oxides: an experimental investigation

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For the paradigmatic oxide heterostructure with $LaAlO_3$ (LAO) thin films grown on $SrTiO_3$ (STO) substrates, distinct electronic phases have been extensively characterized at the LAO/STO interface: for LAO films with more than three layers and LaO termination towards the TiO_2 interface, a two dimensional electronic gas (2DEG) is formed in the STO layers next to the interface [1]. It was concluded, that the primary mechanism responsible for the 2DEG formation is electronic reconstruction.

Since then 2DEG has been later found in other non-magnetic dielectrics. But the common feature for all systems is that the creation of the 2DEG can be due to either the polar nature of one of components or due to defects or dopants. It has been shown that analogous to the ionic polar discontinuity, 2DEG may be created at an interface due to electric polarization discontinuity [2,3]. Attractive materials for such a purpose are ferroelectrics. They have a wide range of different distinctive properties, among them: spontaneous polarization switching, high dielectric permeability, dielectric nonlinearity, piezo- and pyro- activity, linear and quadratic electro-optical effects. That can expand the scope of application in nanoelectronics.

Recently, it has been theoretically predicted that q2DEG can be created at the interface of nonpolar oxides one of which is ferroelectric [2,3]. And In the present work we experimentally test the possibility of such a switchable q2DEG realization. The thin film of epitaxial $Ba_{0.8}Sr_{0.2}TiO_3$ (BSTO) was sputtered on the top of single crystalline $SrTiO_3$ (STO) substrate using the magnetron sputtering technique. We also are investigating bilayer structure $Ba_{0.8}Sr_{0.2}TiO_3/Ba_{0.2}Sr_{0.8}TiO_3$ on MgO. Conductivity measurements were performed by a four-point probe method. In our investigation we present electrical resistivity versus temperature measurements and results are still under consideration.

The reported study was funded by RFBR according to the research project № 18-32-00595.

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