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Experimental investigation of $Ba_{0.8}Sr_{0.2}TiO_3$ (BSTO)/STO heterointerface

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In 2004 the astounding phenomenon was found at the interface between two nonmagnetic wide-band-gap insulative oxides $LaAlO_3$ (LAO) and $SrTiO_3$ (STO) [1]. A two-dimensional electronic system (2DES) is formed in the STO layers next to the interface which becomes superconducting below a temperature of 300 mK [1, 2]. Remarkably, this superconducting state coexists with a magnetic state being stable up to the room temperature. It was concluded, that the primary mechanism responsible for the 2DES formation is the electronic reconstruction followed by structural reconstruction.

Since then 2DES has been later found in other non-magnetic dielectrics. And all of them have in common is that the creation of 2DES is due to either the polar nature of one of components or due to defects or dopants. Later, it has been shown that 2DES can be created at the interface of nonpolar oxides one of which is ferroelectric [3, 4]. The main advantage of using ferroelectrics is a possibility to switch on and off the polarization and thus to control properties of the electron system.

By means of ab initio investigations within DFT calculations we investigated ferroelectric polarization impact onto the conductive properties of the nonpolar $BaTiO_3/SrTiO_3$ heterostructure. We found that polarization towards the interface induce conductivity [5]. At the experimental part the thin film of epitaxial $Ba_{0.8}Sr_{0.2}TiO_3$ (BSTO) was sputtered on the top of single crystalline STO substrate using the magnetron sputtering technique. We also investigated bilayer structure $Ba_{0.8}Sr_{0.2}TiO_3/Ba_{0.2}Sr_{0.8}TiO_3$ on MgO substrate. Conductivity measurements were performed by a four-point probe method. In our investigation we present electrical resistivity versus temperature measurements and those results are still under consideration.

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