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Potential distribution and domain structure of metal-ferroelectric-semiconductor-metal heterostructures RENE MEYER, Stanford University, PAUL MCINTYRE, Stanford University — Recently, we proposed a novel resistive non-volatile memory concept based on the ferroelectric effect. The resistance switching originates from the unscreened polarization charge at the ferroelectric/semiconductor interface, which affects the distribution of the inner electric potential. A depletion or enrichment of mobile charge carriers leads to a reduced or increased conductivity of the near-interface region. The depolarizing field, however, which is inherently present in the ferroelectric in the case of imperfect screening, causes the formation of 180 deg. domains. The resulting alternation of positive and negative polarization charges at the ferroelectric/semiconductor interface could deteriorate the performance of the proposed resistance switch. In this contribution, the domain pattern is studied numerically for a metal-ferroelectric-semiconductor-metal structure. A 2-dimensional finite differences method is used to calculate the inner electric field, the potential distribution and the electrostatic energy under short circuit conditions and for external electric fields. Based on empirical data, the domain size is estimated as a function of the screening efficiency of the electrodes and the applied field. Results of the 2-dimensional model are compared to a 1-dimensional approach, where a voltage dependence of the macroscopic polarization is approximated by an effective polarization.

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