Charge properties of a MOS transistor structure with a channel made of a two-dimensional crystal

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Abstract. For further improvement of efficiency and speed of field transistors the application of semiconductor two-dimensional crystals is possible. Such transistors are devoid of some negative effects, appearing in traditional MOS transistors while decreasing their dimensions. In this paper the model has been proposed and the charge properties of the transistor MOS structure with the channel made of two-dimensional crystal have been investigated. The numerical modeling of such

characteristics has been performed in the range of variation of electro-physical properties of 2D-crystals, typical for MoSe, WS, WSe, ZrSe, HfSe, PtTe. A self-consistent relationship through the chemical potential between the electrophysical parameters of the structure has been established, as well as the influence of potential of field electrode and the gate dielectric potential on them. The performed calculations of the steepness of the transfer characteristic and the amplification coefficient of such transistor structure have shown that for the channel made of the transition metals dichalcogenides with the bandgap in the range of 0.25-2.1 eV the values of given parameters can reach 0.1 mA/V and 1000, respectively.

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