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PARAMETRIC STUDIES OF MODELS OF THE DEEP-SUBMICRON MOSFET

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Permanent reduction of topological feature size of VLSI leads to the appearance of new physical effects, including quantum effects. Physically adequate modeling of microelectronic devices and, in particular, the deep sub-micron MOSFET (<0.13 microns) is only possible taking into account the above effects. In this regard, the problem of development of models that combine high adequacy of the physical results with a reasonable time of calculation is actual. The idea of the proposed new compact model is the use of the standard drift-diffusion approximation in the modeling of charge carrier transport in the sub-micron (> 0.13 micron) devices with the "tuning" of its parameters so that they effectively take into account the quantum effects that are typical for the deep sub-micron devices.

In order to assess the impact of the effects that taken into account in each of these models on the magnitude of the threshold voltage V_{TH} of the MOS transistor parametric studies of standard drift-diffusion (DD) model and quantum Bohm potential (Q) [1] was conducted on the MOSFETs with different channel length. The dependence of $\Delta V_{TH} / V_{TH}^{Q}$ ($\Delta V_{TH} = V_{TH}^{DD} - V_{TH}^{Q}$) from channel length of the studied MOSFET structures is presented at Fig. 1. It can be seen that the degree of manifestation of quantum effects increases with decreasing channel length.

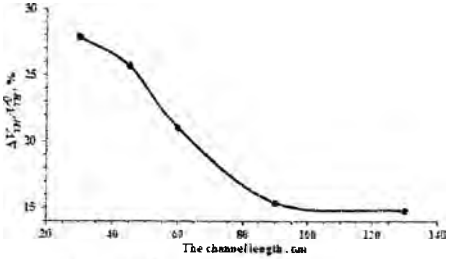

Fig. 1 – Dependence $\Delta V_{TH} / V_{TH}^{Q}$ from the channel length of the MOSFET

References

1. ATLASUser'sManual. Devicesimulationsoftware. SILVACO International, 2012. – 1548 p.