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| **Title:** | Study of Process Parameters Variations on Threshold Voltages for Pocket Implanted NMOSFET using TSUPREM | | |
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| **Abstract:** |  |
| Abstract— As the channel length of MOSFETs is scaled down to a deep sub-micrometer or sub-100 nm regime, we observe short-channel effects (SCE), such as steep threshold voltage roll-off, increased off-state leakage current, and bulk punch-through. To alleviate or suppress the short channel effects, lateral channel engineering utilizing halo or pocket implants surrounding drain and source regions is very effective. Pocket implanted MOS devices show the reverse short channel effect (RSCE) due to in-homogeneity of impurity or doping concentration along the channel. The pocket implantation is done during the fabrication process of the MOS devices by implanting the same type of semiconductor material along the channel at the source and drain side of the MOSFET. The peak of the pocket concentration and extension length of the pockets from the source and drain sides towards the center of the MOSFET along the channel are controlled by changing the various process parameters, such as ion doses, implantation energies, tilt angles, etc. These process parameters strongly affect the threshold voltage of the MOS devices and in turn the device performance. Therefore, it has become necessary to observe the effects of these parameters carefully before going to actual fabrication. Using TSUPREM, a very powerful process simulator, we study and observe the effect of these process parameter variations on the threshold voltage. Then from the TSUPREM generated mesh, we study the device characteristics, such as threshold voltage versus gate length using MEDICI, which is a very powerful device simulator. From the study, we observe that the reverse short channel effect is well controlled by the process parameters of the pocket implanted MOS devices down to 50 nm gate length. | |