SILICON p-MOS AND n-MOS TRANSISTORS WITH UNIAXIALLY STRAINED CHANNELS IN ELECTRONIC DEVICE NANOTECHNOLOGY

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S u m m a r y

The effect of uniaxial stress on the mobility of charge carriers in n-Si and p-Si crystals used for the fabrication of n-MOS and p-MOS transistors is considered. The stress dependences of the longitudinal and transverse tensoresistive effects in p-Si obtained for the principal crystallographic orientations ($X\|[100]$, $X\|[110]$, and $X\|[111]$) are presented. An abrupt decrease of the longitudinal tensoresistive effect in p-Si with increasing stress is due to a reduction of the longitudinal effective mass of heavy holes and the corresponding rise of their mobility. In n-Si, a growth of the uniaxial stress $X\|[100]$ results in the complete removal of f-transitions from intervalley scattering under a large energy splitting of single-type Δ_1-valleys ($\Delta\varepsilon>10$ kT), which leads to an increase of the electron mobility in the temperature range 78–300 K. The change of g-transitions under the splitting of single-type Δ_1 valleys in this temperature interval has no effect on the electron mobility. We also describe technological developments used by "Intel Corporation" for the fabrication of integrated circuits with uniaxially strained channels of MOS transistors.