

The Influence of Stress on Inversion Layer Mobility

E.Ungersböck, H.Kosina, and S.Selberherr

Institute for Microelectronics, TU Wien
Gusshausstr.27-29/E360 A-1040 Wien, Austria
Telephone: +43(1)58801-36010 Fax: +43(1)58801-36099
mailto: Selberherr@TUWien.ac.at

A rigorous electron mobility analysis in stressed ultra-thin-body MOSFETs is presented. The effect of uniaxial stress on the electron mobility was investigated using Monte Carlo transport simulations for (001) and (110) oriented substrates. It is shown, why uniaxial stress leads to a pronounced anisotropy of the in-plane mobility for both substrate orientations. While on (110) substrates this effect stems from the ellipsoidal shape of the lowest subband ladder, an effective mass change induced by [110] stress has to be taken into account to explain the anisotropic mobility of [110] uniaxially stressed (001) wafers. Depending on the substrate orientation the six-fold degenerate X-valley splits into up to three different subband ladders. While on (001) substrates the subbands of the lowest subband ladder (unprimed ladder) are spherical and the ladder is two-fold degenerate, on (110) substrates the subbands are elliptical and the unprimed ladder is four-fold degenerate. The higher density of states and larger transport masses on (110) substrates thus yield a lower inversion layer mobility as compared to (001).