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UV-Raman deformation coefficients in Si and SiGe alloys

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As Si CMOS device scaling issues become increasingly challenging a number of alternatives arise including Si-On-Insulator (SOI) substrates, high-k gate dielectrics, and Strained Si Channel (SSC) devices. In the case of SSC structures, the enhancement in electron mobility depends directly on the stress magnitude. Raman scattering, particularly in the UV due to short penetration depth, has proven well suited for measuring thin SSC layer stress. The technique depends critically on the value taken for the strain shift coefficient (b), which correlates the shift in the phonon frequency with the strain. A number of values have been reported in the literature to date using NIR and visible excitation; however, the authors are unaware of previous work performed specifically in the UV. In this work, we have used a combination of HRXRD reciprocal space mapping (RSM) to measure the in-plane strain of high quality Si/SiGe heterostructures and UV-Raman with the 325nm He-Cd line to determine the Si LO phonon deformation coefficient in Si and SiGe alloys with compositions ranging from 10-40% Ge.

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