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Studies of stressor effects on silicon nanostructures using synchrotron X-ray nanodiffraction[1] ZHONGHOU CAI, Argonne National Laboratory, ASHESH PARIKH, Texas Instruments Inc., PAUL EVANS, University of Wisconsin-Madison — Scaling in the semiconductor industry has been accomplished by reduction in gate length and oxide thickness to enable large-scale decreases in device area and improved transistor performance. Strained silicon offers improved mobility at no significant additional costs. Fundamental understanding of the structural equilibrium between the silicon and the stressors at the device level is critical in manipulating properties for performance gains. The inhomogeneous strains in the silicon channel of nanotransistor devices due the epitaxy and lattice mismatch between Si and SiGe were individually studied using X-ray nanodiffraction at the Advanced Photon Source. Diffraction intensity from the strained silicon of less than $1x10^{-4}$ $\mu m^3$and the SiGe stressor were mapped in reciprocal space around the points of (004), (115), and (-115). Lattice bending up to a few degrees at both sides of the Si/SiGe interface were measured, and the associated strains were quantitatively extracted in functions of the lattice curvature. The effect of the size of stressors was also studied.

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Zhonghou Cai
Argonne National Laboratory

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