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Strain Relaxation in Elastically Strain-Sharing Silicon (110) Nanomembranes[1] DEBORAH COTTRILL, SHELLEY SCOTT, DONALD SAVAGE, MAX LAGALLY, University of Wisconsin-Madison, – TEAM — Tensilely strained Si(110) has potential for advanced CMOS and p-MOS devices because, depending on strain and current direction, hole mobility can be increased to 150% of that of unstrained Si(001) and an electron mobility nearly equal. Previous efforts to strain Si(110) tensilely have relied on the formation of partial dislocations for strain relaxation, resulting in large asymmetric components of the in-plane strain and high threading dislocation densities, which alter device performance. We use thin trilayer heterostructures of Si/SiGe/Si(110) grown with MBE on Si(110)-on-insulator that elastically strain share when released from the handling substrate. Besides their very high flexibility, these nanomembranes (NMs) are virtually dislocation free and exhibit a lower degree of asymmetric in-plane strain relaxation than achieved with threading dislocation relaxation; the NMs rely on elastic strain transfer rather than partial dislocation propagation. We use AFM, XRD, and Raman to characterize growth, strain transfer, and strain anisotropy.

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