Abstract Submitted
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Mechano-electronic Superlattices in Silicon Nanoribbons[1] M. HUANG, C.S. RITZ, B. NOVAKOVIC, F. FLACK, D.E. SAVAGE, P.G. EVANS, I. KNEZEVIC, University of Wisconsin-Madison, D. YU, Y. ZHANG, F. LIU, University of Utah, M.G. LAGALLY, University of Wisconsin-Madison — Single-crystal silicon nanomembranes (SiNMs) have the mechanical compliance fundamentally different from bulk materials or supported thin films that can produce unique structural and electronic effects. The growth of nanostressors on SiNMs utilizes this mechanical compliance to create a "strain lattice" consisting of tiny regions of local curvature in the SiNMs, the order occurring because the locally bending SiNMs provides a strong feedback for self-organization of the nanostressors. We demonstrate that a high degree of order occurs when Ge or SiGe nanostressors are grown on both sides of free-standing but end-tethered Si nanoribbons. Our calculations prove that the strain lattice in the Si produces a modulation in the electronic band structure, and thus an electronic superlattice. Our calculations also demonstrate that discrete minibands can be observable in such an electronic superlattice at 77K. It is expected that an electric conductivity will be increased in the superlattice. We predict that it is possible to observe discrete minibands at room temperature if other nanostressors are used.

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