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Carrier transport in Ge nanowires / Si substrate heterojunction
E.-K. LEE, B. KAMENEV, L. TSYBESKOV, New Jersey Institute of Technology, S. SHARMA, T.I. KAMINS, Hewlett-Packard Laboratories — Semiconductor nanowires (NWs) attached to lattice-mismatched single-crystal substrates form quasi-one-dimensional (QOD) heterojunctions (HJs) where efficient structural relaxation might occur due to high surface-to-volume ratio. Current-voltage characteristics in Ge NW/(p+)Si samples with nearly micron-long Ge NWs exhibit metal-type conductivity with ohmic behavior and little conductivity temperature dependence. In contrast, Ge NW/(n+)Si samples display significant change in conductivity as a function of temperature with an activation energy up to 200 meV. In a narrow temperature interval near 150 K we observed current instabilities and oscillations for Ge NW/(n+)Si. At higher temperatures we find negative differential photoconductivity at low forward biases. Our experimental results are explained using a model of nearly ideal Si substrate/Ge NW hetero-interfaces.

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