Abstract Submitted
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Mechanical Resonance and Damping Properties of Gallium Nitride Nanowires in Selected-Area Growth Arrays Measured via Optical Bragg Scattering[1] JOHN HOULTON, Univ of Colorado - Boulder, M. D. BRUBAKER, K. A. BERTNESS, NIST Boulder, C. T. ROGERS, Univ of Colorado - Boulder — We report the use of optical Bragg scattering to measure the mechanical resonance frequencies and quality factors (Q) of gallium nitride (GaN) nanowires (NWs) in selected-area growth arrays. The GaN NWs are grown by catalyst-free molecular beam epitaxy on silicon (111) wafers. Hexagonal arrays of approximately 100 GaN NWs with pitch spacings of 400 - 1000 nm have been prepared. The NWs contained in such arrays have diameters ranging from 100-300 nm and lengths from 3 - 10 μm. A diode laser operating at 640 nm and 2 mW of optical power is used to perform Bragg scattering homodyne detection to passively read out the thermally induced Brownian mechanical motion of the NWs. The first order cantilever-mode mechanical resonance frequencies of these NWs have been measured to be between 2 - 12 MHz. We find that the optical readout via Bragg scattered light allows the simultaneous detection of all lowest order mechanical resonances in a given array. Q factors ranging from 1,000 - 12,000 have been seen at room temperature and 10^{-5} Torr pressures. Qs as high as 25,000 have been seen at temperatures of 80 K. These results show that the narrow mechanical resonances observed in freely-grown GaN NWs can also be seen in NWs prepared via selected-area growth.

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