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Ensemble Measurements of Temperature Dependence in High-Q GaN Nanowire Mechanical Resonators[1] JOSHUA MONTAGUE, University of Colorado, KRIS BERTNESS, NORMAN SANFORD, NIST Quantum Electronics and Photonics Division, VICTOR BRIGHT, CHARLES ROGERS, University of Colorado — We report on measurements of c-axis oriented, single crystal, gallium nitride nanowire (GaN NW) mechanical resonators. Our measurements use a capacitively-coupled, microwave homodyne reflectometer that allows for simultaneous detection of large ensembles of the as-grown, GaN NW resonators. The NWs - grown via molecular beam epitaxy - behave as singly clamped beams, have lengths near 15 microns, and radii near 100 nm. We observe, respectively, typical resonance frequencies and mechanical quality factors (defined as the ratio of resonance frequency to full width at half maximum power), Q, near 1 MHz and above 10,000, near room temperature [1]. At lower temperatures, we observe increases in resonance frequencies consistent with temperature-dependent elastic moduli. Measured Q factors demonstrate a minimum near 150 K and typically increase an order of magnitude - to above 100,000 - below 100 K.

[1] S.W. Hoch et al., Appl. Phys. Lett. 99(5), 053101 (2011).

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