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High Frequency Nanomechanical Oscillators Based on Synthetic Nanowires

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Abstract : We demonstrate nanomechanical resonators constructed with synthetic nanowires (NWs) and study their electro-mechanical properties at millikelvin temperatures. Nanomechanical resonators are fabricated using single-crystalline Au NWs and InAs NWs. The mechanical resonance signals are acquired by either magnetomotive or capacitive detection methods. The Au NWs are synthesized by chemical vapor transport method at 1100 °C, and they exhibit clean surface and single-crystallinity with little defects. Due to pristine surface quality, these Au NW mechanical resonators could provide an ideal model system for studying surface-related effects on the mechanical systems. The InAs NWs are synthesized by molecular beam epitaxy or metal organic chemical vapor deposition method. The InAs NWs show electronic conductance modulation resembling Coulomb blockade, which also manifests in the mechanical resonance signals in the form of damping and resonance frequency shift. Our result provides an evidence of strong electro-mechanical coupling in synthetic NW nanomechanical resonators.

Keywords : Au nanowire, InAs nanowire, nanomechanical resonator, synthetic nanowires
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