Phonon properties of stressed GaN nanostructures

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GaN nanostructures are the state-of-the-art in the applications of semiconductors-based nanoelectronic devices or nanoelectromechanical systems(NEMS). The phonon properties of semiconductors are playing an essential role in the thermal management of these nanodevices. Here, the phonon performance of GaN nanostructures are studied theoretically under an applied stress fields using continuum elastic theory. Numerical results show that the applied stresses can change the phonon dispersion relationship of GaN nanofilms and nanowires significantly, as well as the phonon average velocity and phonon state density. The tensile/compressive stress can reduce/increase the phonon thermal conductivity. It is also found that the applied stresses can alter the size and temperature dependence of phonon thermal conductivity in GaN nanostructures. This work would be useful and helpful to tune the thermal properties by controlling the phonon performance through strain/stress engineering.

Key Words: *Phonon dispersion relation; Elastic model; GaN Nanstructures; Strian Engineering*