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Phononics and elastic moduli in polymeric and biological nanostructures RYAN HARTSCHUH, JOHNATHAN NEISWINGER, HUIMING XIONG, ALEXANDER KISLIUK, ALEXEI SOKOLOV, The University of Akron, STEPHEN WARGACKI, RICHARD VAIA, Wright Patterson AFB/MLBP, COLLABORATIVE CENTER IN POLYMER PHOTONICS COLLABORATION —
Mechanical stability of nanostructured materials is of paramount importance for any nanotechnology. However, measuring mechanical properties at such small scales and understanding their dependence on confinement effects remain a great challenge. We use Brillouin light scattering to study the vibrational spectra and mechanical moduli of polymeric and biological nanostructures. We demonstrate that elastic properties neither change nor appear anisotropic in polymeric lines as narrow as 80 nm. As biological nanomachines, viruses may be useful for various applications ranging from gene therapy and drug delivery to photonic crystals. Analysis of phononic spectra of viral structures indicates strong mechanical coupling between viruses, helping to explain the stability of structures formed by viruses. Spectral analysis further indicates that DNA cores of viruses, not their protein shell, dominate elastic properties of viruses, in contrast to traditional model assumptions. This new finding will impact not only nano-patterning, but also biomedical applications involving viruses and possible treatments of viral infections.

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