Abstract Submitted
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Shear elastic constants of thin films of the misfit layered compound $[(\mathbf{SnSe})_{1.05}]_n[\mathbf{MoSe}_2]_n$[1] DONGYAO LI, University of Illinois, GAVIN MITCHSON, DAVID JOHNSON, University of Oregon, ANDRE SCHLEIFE, DAVID CAHILL, University of Illinois — Crystalline materials with interlayer van der Waals bonding typically have low stiffness for shear deformation that reduces the through-plane thermal conductivity and facilitates the use of layered materials as solid-state lubricants. In graphite and MoS_2, c_{44} =5GPa and 18GPa respectively. The shear modulus of incommensurate layered materials is expected to be strongly reduced relative to ordered crystals but the magnitude of the suppression is currently unknown. We have recently developed an approach for measuring the shear modulus of thin layers using GHz surface acoustic waves (SAW). $[(SnSe)_{1.05}]_n[MoSe_2]_n$ with n=1-4 were prepared as thin films (60 nm) on Si substrates using the modulated elemental reactants technique. The SAW velocity v_{SAW} of Al/[(SnSe)($MoSe_2$)]/Si structures was measured using a polydimethylsiloxane (PDMS) phase-shift optical mask in a pump-probe system. c_{44} was determined by fitting the measured v_{SAW} to the calculated SAW velocity using multi-layer SAW model. c_{33} was measured by picosecond acoustics. c_{11}, c_{12} and c_{13} were calculated using density functional theory (DFT) with van der Waals correction. The measured c_{33} and c_{44} are compared with the DFT prediction. Experimentally we obtain c_{44} =1.9GPa, 1.2GPa, and smaller than 0.05GPa for n=1, 2 and 4.

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