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Temperature-Dependent Structural Characterization of Type-II Dirac Semi-Metal nite$_2$ From Bulk to Exfoliated Thin Flakes Using Raman Spectroscopy

Authors : Minna Theres James, Nirmal K Sebastian, Shoubhik Mandal, Pramita Mishra, R Ganesan, P S Anil Kumar

Abstract : We report the temperature-dependent evolution of Raman spectra of type-II Dirac semimetal (DSM) NiTe2 (001) in the form of bulk single crystal and a nanoflake (200 nm thick) for the first time. A physical model that can quantitatively explain the evolution of out of plane A1g and in-plane E1g Raman modes is used. The non-linear variation of peak positions of the Raman modes with temperature is explained by anharmonic three-phonon and four-phonon processes along with thermal expansion of the lattice. We also observe prominent effect of electron-phonon coupling from the variation of FWHM of the peaks with temperature, indicating the metallicity of the samples. Raman mode E1 1g corresponding to an in plane vibration disappears on decreasing the thickness from bulk to nanoflake.

Keywords : raman spectroscopy, type 2 dirac semimetal, nickel telluride, phonon-phonon coupling, electron phonon coupling, transition metal dichalcogonide
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