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Temperature dependence of optical phonon bands in GaP NUWANJULA SAMARASINGHA , STEFAN ZOLLNER, New Mexico State University — We explore the effect of temperature on the frequency and linewidth of transverse (TO) and longitudinal (LO) optical phonons in bulk gallium phosphide (GaP) using FTIR ellipsometry from 0.03 to 0.80 eV from 80-720 K. We extract the optical phonon features of GaP by fitting our ellipsometric spectra with the Lowndes–Gervais model, which applies two different broadening parameters to the TO and LO phonons. In GaP, the two-phonon density of state is larger for the decay of TO phonons than for LO phonons. Therefore, we observed a large TO phonon broadening and an asymmetric reststrahlen line shape (compared to the LO phonon). This leads to a negative dielectric constant (ε_2) just above the LO phonon. Two-phonon absorption can be added in the model to avoid this negative ε_2. We find a temperature dependent redshift and broadening of TO and LO phonons with increasing temperature due to anharmonic phonon-phonon decay [1]. These temperature dependent phonon features can be described by three and four phonon decay processes. Also, we investigate the temperature-dependence of the high-frequency dielectric constant. Its variation is explained by thermal expansion and the temperature dependence of the band gap. Reference [1] M. Balkanski, R. F. Walls, and E. Haro, Phys. Rev. B 28, 1928 (1983)

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