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Behavior of Phonons in the Optical Properties of Magnetron Sputtered ZnO SANDEEP SOHAL, YAHYA ALIVOV, ZHAOYANG FAN, MARK HOLTZ, Texas Tech University — Resonance Raman scattering and photoluminescence (PL) emission measurements have used to study the temperature dependence of phonons in the wide band gap semiconductor ZnO. There are strong resonance Raman features observed with excitation wavelength 363.8 nm (photon energy 3.409 eV). Near room temperature, this photon energy correspond to incoming resonance as confirmed by absorption spectrum. Broad PL is seen at room temperature with peak position at 3.25 eV. This coincides with the overtone of longitudinal optic (LO) band. Strong electron-phonon interactions in ZnO allow six LO phonon orders to be observed in Raman spectrum. Temperature dependence of the LO phonon energy is described by a two phonon decay mechanism with energies 100 and 496 cm^{-1}. The temperature dependence of the PL shift is described by physical approach and two vibrational energies corresponding to the center of the acoustic and optic bands in the DOS, i.e., 125 and 500 cm^{-1}. LO phonon sidebands (PSBs) are also observed at low temperature (23-100K). The temperature shift of the PSB energies are interpreted on the basis of the band gap shift combined with established theory for the PSBs.

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