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Optical Properties of III-V Semiconductors in Wurtzite Phase

AMRIT DE, University of California - Riverside, CRAIG PRYOR, University of Iowa — A number of recent experiments have shown that the photoluminescence intensity in free standing nanowires is polarization dependent. One contribution to this effect is the optical anisotropy arising from the tendency of the nanowires to crystallize in wurtzite form. We calculate the frequency dependent dielectric functions for nine non-Nitride wurtzite phase III-V semiconductors (AlP, AlAs, AlSb, GaP, GaAs, GaSb, InP, InAs and InSb), based on our maximally constrained empirical pseudopotential bulk band structure calculations. Their complex dielectric functions are calculated in the dipole approximation for polarization perpendicular and parallel to the c-axis of the crystal. We also predict their reflectivity spectra and the static dielectric constants. Optical selection rules are used to explain key features of the dielectric functions. In general it is seen that the III-V wurtzite phase semiconductors exhibit strong optical anisotropy which suggests that they could be potentially useful as nonlinear optical crystals.

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