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Carrier Dynamics and Band Structure of GaAsSb and GaAsSb/InP Nanowires[1] IRAJ SHOJAEI, SAMUEL LINSER, GIRIRAJ JNAWALI, NADEEKA WICKRAMASURIYA, HOWARD JACKSON, LEIGH SMITH, Department of Physics, University of Cincinnati, Cincinnati, OH, XIAOMING YUAN, PHILIPPE CAROFF, HOE TAN, CHENNUPATI JAGADISH, Department of Electronic and Materials Engineering, Australian National University, Canberra, Australia — We utilize transient Rayleigh scattering (TRS) measurements to investigate the dynamics of photoexcited carriers and the band-structure of zincblende GaAsSb and GaAsSb/InP single semiconductor nanowires. The measurements are performed at 300K and 10K by exciting the samples with 1.5 eV 150 fs pulses and probing with pulses tunable from 0.8 to 1.2 eV. The core-only nanowires exhibit uniformly short lifetimes (3 ps) at both 10 and 300K. In comparison, core-shell nanowires exhibit 15 times longer lifetime at low temperatures (670 ps) compared to room temperature measurements (40 ps). Some core-shell nanowires exhibit a 10K lifetime as long as 1700 ps. The 30% Sb core-only nanowires reveal weak spectral structure near the band edge energy of 0.88 eV at both temperatures, while the 30% core-shell nanowires exhibit strong band-edge signals at 0.87 eV at room temperature and at 0.98 eV at 10K. We present a fitting model based on direct band-to-band transition theory to extract the electron-hole-plasma density and temperature as a function of time-delay from TRS measurements from single nanowires.

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