Abstract Submitted
for the OSF13 Meeting of
The American Physical Society

Transient Rayleigh Spectroscopy measure of Carrier Dynamics in Wurtzite and Zincblende InP nanowires YUDA WANG, MOHAMMAD MONTAZERI, HOWARD JACKSON, LEIGH SMITH, Univ. of Cincinnati, JAN YARRISON-RICE, Miami Univ., TIM BURGESS, CHENNUPATI JAGADISH, Australia National Univ. — Pump-probe two color transient Rayleigh spectroscopy is used to study the carrier dynamics of the WZ and ZB InP nanowires. Both nanowires were grown by MOCVD with both diameters ∼100nm. Utilizing wavelength-tunable pulse laser generated by super-continuum fiber excited with Ti-Sapphire Laser and a time delay line adjusting the time difference between the pump and probe pulse, the change of the reflectivity as a function of excitation energy and time delay after pump can be measured from a single nanowire. The results are fitted based on the absorption coefficient calculated by a band to band transition model and index of refraction correlated by the Kramer-Kronig relation. The temperature of the electron-hole plasma(EHP) is cooled by the interaction with LO phonons and Acoustic phonons. The EHP-LO phonon cooling mechanism is dominating at early times from 0 to 200ps(ZB) and 500ps(WZ), after which the EHP-acoustic phonon interactions begin to contribute more. The carrier relaxation time constants were also fitted for different bands. The conduction bands of ZB and WZ InP show lifetimes of 1500ps and 2000ps, respectively. Both the Split-Off band in ZB InP and C band in WZ InP show slow relaxation time constants compared to the rest of the valence bands by a factor of 2-3.

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Date submitted: 13 Sep 2013 Electronic form version 1.4