Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Population Dynamics of Excitons in Polytype Wurzite-Zincblende InP Nanowires[1] HANS-PETER WAGNER, MASOUD KAVEH, Department of Physics, University of Cincinnati, WOLFGANG LANGBEIN, School of Physics and Astronomy, Cardiff University, U.K., QIAN GAO, CHENNUPATI JAGADISH, Department of Electronic Materials Engineering, Australian National University, Canberra, Australia, GERD DUSCHER, Department of Materials Science and Engineering, University of Tennessee, Knoxville — We investigate the population dynamics of excitons in polytype wurzite/zincblende (WZ/ZB) InP nanowires using heterodyne four-wave-mixing (HFWM) in three-beam configuration at LN temperature. The photon energy of exciting 100 fs pulses was set to 1.44 eV and 1.49 eV, resonant to excitons in ZB and WZ segments, respectively. Pump pulse fluences were varied from 0.16 to 3.2 μJ/cm^2. At 1.44 eV pulse energy the HFWM amplitude shows a rapid initial decay on a sub-picosecond time-scale indicating a fast conversion of ZB excitons into spatially indirect excitons at the WZ/ZB interface. For longer delays the HFWM amplitude reveals a nearly mono-exponential decay time of 2 ns at lowest pump fluence which is assigned to the lifetime of indirect electron-hole pairs. With increasing pulse fluence the decay dynamics becomes multi-exponential which is attributed to state filling of higher-energy indirect excitons. At 1.49 eV pulse energy the HFWM amplitude reveals an additional rapid decay on a 10 ps time-scale which is tentatively assigned to the trapping of A-excitons at point-defects in the WZ segments. The observed dynamics is modeled by coupled rate-equations.

[1]URC support and of the Australian Research Council is acknowledged.

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Date submitted: 15 Nov 2013 Electronic form version 1.4