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Dephasing and Population Dynamics of Electron-Hole-Pairs in AlGaAs/GaAs Core-Shell Nanowires H.P. WAGNER, M. KAVEH, University of Cincinnati, Q. GAO, C. JAGADISH[1], Australian National University, Canberra, Australia, W. LANGBEIN, Cardiff University, Cardiff, U.K., G. DUSCHER, University of Tennessee, Knoxville — We investigate the dephasing and population dynamics of electron-hole-pairs (EHPs) in VLS grown zincblende AlGaAs/GaAs core-shell nanowires (NWs) using heterodyne four-wave mixing (HFWM) in three-beam configuration at liquid nitrogen temperature. In the experiments the photon energy of the 100 fs excitation pulses was set resonant (1.51 eV) and below (1.49 eV) the band-gap energy. At 1.51 eV photon energy the HFWM amplitude shows a rapid initial decay on a sub-ps time-scale indicating a fast relaxation of photo-excited EHPs to their band edges via carrier-carrier scattering. For longer delays the HFWM amplitude reveals a decay time of 500 ps which is attributed to the EHP lifetime. At 1.49 eV pulse energy the signal due to EHPs is significantly reduced and the HFWM amplitude shows an increase with maximum at 10 ps and subsequent decay with a time constant of more than 20 ns. The observed signal is attributed to the excitation of background carriers with subsequent redistribution and capture at impurities with long residence time. Photon echo experiments of resonantly excited EHPs reveal a dephasing time in the order of 100 fs. We attribute this fast dephasing to carrier scattering with a high carrier background provided by the impurities in these NWs.

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