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Photoluminescence Study of Type II ZB-WZ InP nanowire homostructures K. PEMASIRI, M. MONTAZERI, R. GASS, H.E. JACKSON, L.M. SMITH, University of Cincinnati, J.M. YARRISON, Miami University, S. PAIMAN, Q. GAO, H.H. TAN, C. JAGADISH, Australian National University, X. ZHANG, J. ZOU, University of Queensland — We use CW and time-resolved photoluminescence (TRPL) from single InP nanowires containing both wurtzite (WZ) and zincblende (ZB) crystalline phases to study the quantum confinement of excitons in a Type-II homostructure. We observe strong excitation power dependence, with a change in PL emission energy from the ZB edge to the WZ edge suggesting that the nanowires have mixed phases. TRPL shows a dramatic increase of recombination lifetime from 170 ps for excitons in the continuum above the conduction and valence band barriers to more than 8400 ps for electrons and holes which are strongly confined in quantum potential wells defined by monolayer-scale ZB sections in a predominantly WZ nanowire. Using detailed HR TEM measurements from a 600nm length of a single nanowire, we calculate a complete set of electrons and hole confined states using an eigenfunction expansion method. Analysis of the distribution of electron and hole confined states demonstrates that the observed energy-dependent dynamics are consistent with the type II nature of the confined electron and hole wavefunctions. Supported by the NSF (#0701703 and #0806700) and the Australian Research Council.

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