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Photoluminescence dynamics of single InP nanowires L.V. TITOVA, A. MISHRA, THANG B. HOANG, H.E. JACKSON, L.M. SMITH, University of Cincinnati, J.M. YARRISON-RICE, Miami University, H.J. JOYCE, Y. KIM, Q. GAO, H.H. TAN, C. JAGADISH, Australian National University — We use time-resolved photoluminescence (PL) spectroscopy to study exciton dynamics in single InP nanowires prepared by catalyst-assisted vapor-liquid-solid growth. In contrast to other III-V materials like GaAs, InP has a lower surface recombination velocity, which should result in longer excitonic lifetimes and higher quantum efficiencies. Indeed, the InP nanowires exhibit emission lifetimes ranging from 80 ps to 2 ns compared to <80 ps lifetimes observed for GaAs/AlGaAs nanowires. The large variation in the lifetimes from nanowire to nanowire may be the result of structural inhomogeneities and defects that act as nonradiative recombination centers, thus limiting the excitonic lifetimes. In addition, we have observed changes in the recombination dynamics for single InP nanowires as a function of energy. On the high energy side of the PL peak, the recombination rate is rapid (∼50 ps), while on the low energy side it is significantly slower (up to 1 ns) due to the spectral diffusion of carriers. Preliminary polarization measurements show rapid depolarization of the PL during the ∼75 ps emission risetime due to spin scattering of excitons. Financial support for this work was provided by the University of Cincinnati and the Australian Research Council.

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