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Photocurrent spectroscopy of single InP nanowires A. MAHARJAN, H.E. JACKSON, L.M. SMITH, A. KOGAN, University of Cincinnati, J.M. YARRISON-RICE, Miami University, S. PAIMAN, Q. GAO, H.H. TAN, C. JAGADISH, Australian National University — We use photocurrent spectroscopy of single InP nanowires at room temperature to study nanowires having either zinc-blende (ZB) or wurtzite(WZ) crystal structures. Photolithography is used to fabricate the Ti/Al metal contact pads separated by 3 microns on several ZB or WZ InP nanowires. The metal- semiconductor-metal contacts are modeled based on thermionic emission and field emission theory. Analysis of the dark I-V characteristics of these devices determines important intrinsic properties including donor density, barrier heights and electrical conductivity. Current-voltage (I-V) photocurrent curves for a nanowire are obtained by broad illumination of the device from a Ti-Sapphire laser with energies ranging from 1.30 eV to 1.55 eV.The photocurrent at a given bias voltage is plotted as a function of photon energy to determine the band edge of given semiconductor nanowire. The photocurrent drops exponentially below the band edge reflecting Urbach's rule. We find that the energy band gaps of wurzite and zinc blende nanowires are 1.42 eV and 1.34 eV respectively at room temperature showing that the energy band gap of wurtzite structure is about $\sim$80 meV higher than zinc blende structure. Supported by the NSF (# 0701703, # 0806700 and # 0804199) and the Australian Research Council.

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