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Morphology and temperature dependence of single CdS nanowire photoluminescence THANG B. HOANG, L.V. TITOVA, H.E. JACKSON, L.M. SMITH, Univ. of Cincinnati, Cincinnati, OH, J.M. YARRISON-RICE, Miami Univ., Oxford, OH, J.L. LENSCH, L.J. LAUHON, Northwestern Univ., Evanston, IL — We study the optical properties of single CdS nanowires (grown by VLS method using 50 nm catalysts) using the technique of micro-PL. We studied ten wires, several that were straight and uniform, and others with morphological irregularities. At room temperature, the PL spectra of all wires are alike and consist of a single line around 2.41 eV. At low temperature (5 K), the PL properties of these two groups of wires differ significantly: the spectra of the uniform wires display a single peak near the band edge, and the spectra of the irregularly shaped wires exhibit a series of sharp lines at lower energies. Detailed PL imaging reveals that the sharp lines are emitted only from particular positions along the wires. Moreover, most of the photons emitted at low temperatures occur at energies below the band edge PL of bulk CdS. This suggests that the sharp lines result from defects or surface states which rapidly trap carriers from the bulk of the wires. As the temperature increases, the sharp lines begin to weaken at about 30 K and completely disappear at 85 K, while a peak which emerges from the high energy shoulder of the low-T emission band becomes dominant and survives up to room temperature. We acknowledge the support of ACS through PRF, and NSF through grants 0071797, 0216374, and a graduate fellowship (JLL).

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