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Photoluminescence Characterizations of Ultra-fine ZnO nanowires CHUNG-JEN CHIEN, PAI-CHUN CHANG, JIA G. LU, University of Southern California, DANIEL STICHTENOTH, CARSTEN RONNING, University of Goettingen, Germany — ZnO nanowires as 1D materials display novel and unique physical properties. For the optical properties, the origin is attributed to (i) large surface to volume ratio which results in increased surface states, (ii) waveguiding property which is typical for the 1D structure, and (iii) reduced dimensionality which results in a quantum confinement. Due to the rather small exciton bohr radius in ZnO the latter effect is expected only for wires with a diameter smaller than 5 nm. Here we present luminescence studies of ZnO nanowires with diameters in this range. The nanowires were synthesized using two different methods: pulsed laser deposition and carbon thermal. TEM studies show their excellent crystalline quality, with diameters ranging between 2 and 40 nm. Temperature dependence photoluminescence (PL) measurements were carried out on the as-grown samples. At low temperatures, the spectra are dominated by a feature at 3.366 eV, which is attributed to a surface bound exciton. With rising temperature, four phonon replica of the free excitonic transition are observed, showing quantum confinement effect in the ultra-fine nanowires. These results will be discussed together with μ-PL measurement on single nanowires.

Jia G Lu
University of Southern California

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