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Enhanced Free Exciton and Direct Band-Edge Emissions at Room Temperature in Ultrathin Zn0 Films Grown on Si Nanopillars by Atomic Layer Deposition PEI-YUAN CHU, YUAN-MING CHANG, Department of Electrophysics, National Chiao Tung University, JIANN SHIEH, Department of Mateirals Science and Engineering, National United University, JENH-YIH JUANG, Department of Electrophysics, National Chiao Tung University — Room-temperature ultraviolet (UV) luminescence was investigated for the atomic layer deposited ZnO films, which were grown on silicon nanowires (Si-NWs) fabricated by self-masking dry etching in hydrogen-containing plasma. For films deposited at 200° C, an intensive UV emission corresponding to free-exciton recombination (3.31eV) was observed with a nearly complete suppression of the defect-associated broad visible range emission peak. On the other hand, for ZnO films grown at 25° C, albeit the appearance of the abovementioned defect-associated broad visible emission, the UV emission peak was observed to shift by 60meV to near the direct band edge (3.37 eV) recombination emission. The high resolution transmission electron microscopy (HRTEM) examinations showed that, indeed, the microstructure of the obtained ZnO films for the former case was of continuous crystalline nature, while that for the latter displayed a microstructure consisting of ZnO nanocrystals with a mean diameter of 4nm embedded in a largely amorphous matrix. The blue shift of the UV emission peak in the latter films, thus, might have been due to the effects of quantum confinement on the free-exciton recombination.

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