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Size effect of diverse ZnO nanostructures LIN FENG, CHUN CHENG, BAODIAN YAO, NING WANG, MICHAEL LOY, Physics Department, the Hong Kong University of Science and Technology — ZnO nanostructures including nanowires, tetrapods and nanocrystals are investigated by low temperature photoluminescence spectroscopy at 20K and 90K. Three peaks at 3.360, 3.308 and 3.235 eV are attributed to recombinations of bound excitons (BX), the first and second order longitudinal optical replicas of free excitons respectively. At 20 K, the 3.360eV BX peak is dominant for all these ZnO nanostructures, and B_F, defined as the intensity ratio of BX line to the sum total of the three lines above, is close to unity. At 90K, we find the size dependence of B_F. Among the nanowires and tetrapods, B_F changes monotonically from 0.7 for radius of 100nm, to less than 0.2 for r=2 μm. For nanocrystals, B_F varies from 0.4 at r=100nm to less than 0.17 at r=600nm. A simple model is presented, in which nanowires and tetrapod legs are approximated by cylindrical geometry and nanocrystals by spheres, suggesting the above size dependency is due to the inhomogenous density distribution of the defects as binding sites for BX. These defects might also be responsible for the so-called "anomalous blueshift" of the NBE peak at RT.

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