ZnO nanowires for photonic applications

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The quest for novel semiconductor materials with improved optoelectronic performance has triggered intense research activities to exploit the great diversity of effects offered by low dimensional systems. In this work, we investigate the influence of the ZnO nanowires (NWs) growth parameters on the ir optical properties . ZnO NW s have been grown by the vapor transport method using Au as catalyst over quartz and SiO 2 /Si substrates with lengths and diameters ranging from 0.2 to 2 m and 40 to 200 nm, respectiv ely. Room temperature absorption spectra show a well defined exciton peak in the ultraviolet. Photoluminescence measurements show two emission bands at room temperature, the exciton emission peak in the ultraviolet, and a very broad emission band in the vi sible range from 420 to 800 nm, which exhibits three distinct peak like contributions in the Green, Yellow and Red at around 520, 590 and 720 nm (2.38, 2.10 and 1.72 eV), respectively. The intensities of these emission bands in the visible change as a func tion of the ZnO NW growth parameters, which correspond to different defect related recombination processes, and were clearly correlated with the quantity and type of defects p resent in the material. We show that the intensity of the broad emission band in the visible increases relative to that of the exciton emission as the ZnO NWs diameter decreases . This result is of great relevance regarding future devices based on these nanostructures since a detailed understanding of the origin of the shell states (sur face states) is mandatory for a precise device design. The highly spatially localized nature of the shell states is a fundamental aspect to control in applications where charge transfer processes play a key role, e.g., detectors such as gas sensors, or even ph otocatalytic activity.