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Effects of B Doping on Structural, Optical, and Electrical Properties of ZnO Nanorods Grown by Hydrothermal Method

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ZnO seed layers were deposited on a quartz substrate using the sol-gel method, and B-doped ZnO (BZO) nanorods with different B concentrations ranging from 0 to 2.5 at.% were grown on the ZnO seed layers by the hydrothermal method. The structural, optical, electrical propertiesof the ZnO and BZO nanorods were investigated using field-emission scanning electron microscopy, X-ray diffraction (XRD), photoluminescence (PL), ultraviolet-visible spectroscopy, and hall effect. The ZnO and BZO nanorods grew well aligned on the surface of the quartz substrates. From the XRD data, it can be seen that the B doping is responsible for the distortion of the ZnO lattice. The PL spectra show near-band-edge emission and deep-level emission, and they also show that B doping significantly affects the PL properties of ZnO nanorods. The optical band gaps are changed by B doping, and thus the Urbach energy value changed with the optical band gap of the ZnO nanorods. From the hall measurements, it can be observed that the values of electrical resistivity, carrier concentration, and mobility are changed by B doping.

Keywords: Zinc oxide, Boron, Doping, Hydrothermal, Hall Effect