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Optical Properties of ZnO Soccer Ball Structures by Using Vapor Phase Transport

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ZnO was grown on a Au-catalyzed Si(100) substrate by using a simple vapor phase transport (VPT) with a mixture of zinc oxide and graphite powders. The ZnO grown at 800°C had a soccer ball structure with diameters of <500 nm. The ZnO soccer ball structure was, for the first time, observed in this work. The optical properties of the ZnO soccer balls were investigated by photoluminescence (PL). In the room-temperature (RT) PL of the ZnO soccer balls, a strong near-band-edge emission (NBE) and a weak deep-level emission were observed at 3.25 and 2.47 eV (green emission), respectively. The weak deep-level emission (DLE) at around 2.47 eV (green emission) is caused by impurities and structural defects. The FWHM of the NBE peak from the ZnO soccer balls was 110 meV. In addition, the PL intensity ratio of the NBE to DLE was about 4. The temperature-dependent PL was also carried out to investigate the mechanism governing the quenching behavior of the PL spectra.

Keywords: Zinc oxide, Soccer ball, Vapor phase transport, Scanning electron microscopy, Photoluminescence