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# Influence of Bi doping on the structure and photoluminescence of ZnO phosphor synthesized by the combustion method

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## Abstract

Bismuth doped ZnO (BZO) phosphors have been synthesized by the combustion method. The effect of Bi doping up to 4 mol% on the structural, morphological, optical and photoluminescence (PL) properties have been investigated. X-ray diffraction analysis revealed that the BZO phosphors had the hexagonal wurtzite structure. The nanocrystallite size decreased from 75 to 38 nm as the Bi concentration increased up to 3 mol%, but then increased slightly for 4 mol% Bi. The chemical states of the synthesized BZO phosphors were investigated using X-ray photoelectron spectroscopy and revealed the presence of both $Bi^{3+}$ and $Bi^{2+}$ charge states. The surface morphology showed spherical grains with some small particle agglomeration. The grain agglomeration and irregular shapes increased with increasing Bi concentration in the BZO phosphor. The absorption spectra were calculated from the reflection spectra using the Kubelka-Munk function and a blue shift in the absorption was obtained. The optical bandgap varied from 3.08 to 3.11 eV for increasing Bi doping concentration. The PL spectra showed a blue emission at 410-500 nm and a broad red peak at 650 nm. These peaks are attributed to oxygen related defects in the ZnO host. The addition of Bi decreased the red emission and enhanced the blue emission.

**Keywords:** ZnO, Bi, phosphor, defects.