Tailoring of the optical and electrical characteristics of ZnO: Ga heterostructures by a metallic buffer layer

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Abstract:

Due to its excellent transmittance, high UV emission, higher environmental and thermal stability, abundance of resources, and inexpensive cost for use in many sophisticated applications, nano-dimensional ZnO has received a lot of attention. In this regard, we present information on the photoluminescence and structural characteristics of thin films of Ga-doped ZnO made using pulsed laser deposition. A methodical presentation of the significant impact of Au and Ag as an interlayer on Ga-doped ZnO thin films has been made. According to X-ray diffraction examination, the generated films' crystalline microstructure was correctly aligned along (002) lattice planes with a hexagonal wurtzite structure. A surface analysis using a field emission scanning electron microscope revealed the films' surfaces to have very little surface roughness. With the addition of metallic interlayers, these films demonstrate an improvement of twofold photoluminescence behavior in the vicinity of band edge emission. Using an IR spectrophotometer, the resulting films' band gap energies ranged from 3.29 to 3.52 eV. Ga-doped ZnO offers a novel technique to replace other UV and IR photodetectors since reflection spectra show less reflectance (16%) and increased absorption in the UV-NIR region.