Influences of Lead and Magnesium co-doping on the Nanostructural, Optical properties and Wettability of Spin Coated Zinc Oxide Films

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Abstract

The quality and optical homogeneity of thin films are necessary for optoelectronic devices and semiconductor technology. The influence of Pb doping, $Zn_{1-x}Pb_xO$ ($0 \leq x \leq 0.05$), and Mg co-doping, $Zn_{0.95-y}Pb_{0.05}Mg_yO$ ($0 \leq y \leq 0.05$), on the microstructural properties, optical parameters and wettability of ZnO films were investigated. X-ray diffraction (XRD) and field emission-scanning electron microscopy (FE-SEM) results show that the films have polycrystalline and hexagonal structure with a preferred (002) orientation combined with wrinkle net-work structure for the Pb doped films. The crystalline quality is slightly enhanced with the Pb doping and then deteriorated after Mg co-doping. The influences of the crystallinity and chemical composition on the film wettability are studied. All films show transparency between 85- 93%. The reflectance and optical band gap of ZnO films decrease for Pb doping and then increase with Mg co-doping. Well-known Swanepoel's method is employed to determine the refractive index (n) and film thickness (d). The influences of Pb and Mg co-doping on the Urbach energy and optical dispersion parameters are also discussed.

Keywords: co-doping; ZnO films; wettability; wrinkle structure; optical constant; refractive index

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