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Characterization of Films Prepared by Aerosol Spray Deposition in the (MgO)x(In2O3)(1−x) System

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Abstract

In this paper nanostructured thin films with thickness of 150 nm have been prepared by aerosol deposition method on p-Si in the system (MgO)x(In2O3)(1−x) with the composition range x = 0.2, 0.4 and 0.6, using indium chloride and magnesium chloride as precursors. The produced films were investigated by scanning electron microscopy (SEM) and atomic force microscopy (AFM) to determine the morphology and roughness, energy dispersive X-ray (EDX) analysis for the chemical composition estimation, and X-ray diffraction (XRD) for establishing the structural and crystallographic phases. It was found that the nano-crystallites sizes grow with increasing the Mg content, therefore influencing the roughness of the films. The film surface roughness calculated from topographic AFM images is in the RMS range from 5.7 to 7.5 nm with increasing Mg concentration, but the value of the Coefficient of Kurtosis parameter is from 0.18 to 0.64. The evolution of the crystalline phases content with increasing the x value from 0.2 to 0.6 was established. The electrical and photoelectrical properties were studied by I-V characterization under the illumination with the light with the wavelength of 365 nm. It was shown that the films are sensitive to this radiation with the ratio of the photocurrent to the dark current from 5 to 7 at the excitation density of 2.4 mW/cm^{-2}.

Keywords: aerosol spray deposition, nanostructured thin films, scanning electron microscopy, atomic force microscopy, nano-crystallites, crystalline phases

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