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Nonlinear optical parameters of nanocrystalline AZO thin film measured at different substrate temperatures

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Abstract

The 2.2 wt% of aluminum (Al)-doped zinc oxide (AZO) transparent and preferential c-axis oriented thin films were prepared by using radio frequency (DC/RF) magnetron sputtering at different substrate temperature ranging from room temperature to 200 degrees C. For structural analysis, X-ray Diffraction (XRD) and Atomic Force Electron Microscope (AFM) was used for morphological studies. The optical parameters such as, optical energy gap, refractive index, extinction coefficient, dielectric loss, tangent loss, first and third order nonlinear optical properties of transparent films were investigated. High transmittance above 90% and highly homogeneous surface were observed in all samples. The substrate temperature plays an important role to get the best transparent conductive oxide thin films. The substrate temperature at 150 degrees C showed the growth of highly transparent AZO thin film. Energy gap increased with the increased in substrate temperature of Al doped thin films. Dielectric constant and loss were found to be photon energy dependent with substrate temperature. The change in substrate temperature of Al doped thin films also affect the non-linear optical properties of thin films. The value of $\chi^{(3)}$ was found to be changed with the grain size of the thin films that directly affected by the substrate temperature of the pure and Al doped ZnO thin films. (C) 2015 Elsevier B.V. All rights reserved.

Keywords

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