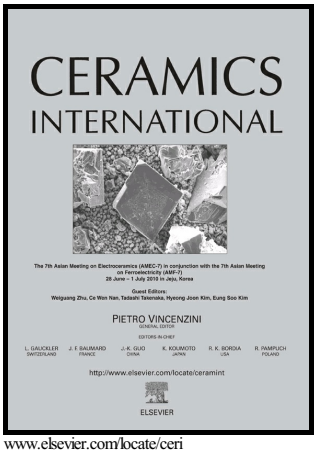

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Improved physical properties of Al-doped ZnO thin films deposited by unbalanced RF magnetron sputtering

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Abstract

Room temperature Al-doped ZnO (AZO) thin films with improved crystalline and optical properties were grown on normal glass substrates using unbalanced RF magnetron sputtering technique. To modify the plasma density towards the substrate and enhance the crystalline nature, an additional magnetic field ranging from 0 to 6.0 mT has been applied to the AZO target by proper tuning of solenoid coil current from 0 to 0.2 A respectively, which plays a significant role for controlling the physical properties of AZO films. The results from XRD studies indicate that all AZO films were composed of hexagonal wurtzite structure with better crystal quality through the applied magnetic field, ZnO (002) plane as a preferred growth. Furthermore, XPS studies suggested that symmetric chemical shifts in the binding energies for the Zn 2p and O1s levels with applied magnetic field. SEM analysis revealed the formation of a smooth, homogeneous and dense morphological surface with applied magnetic field. From AFM analysis, it was observed that the applied magnetic field strongly influenced the grain size and the films showed decreasing tendency in electrical resistivity. Films exhibited superior optical transmittance more than 94 % in the visible region essentially due to the formation of better crystalline nature. The results indicate that improved band gap from 3.10 to 3.15 eV with additional magnetic field varied from 0 to 6.0 mT respectively.

Key words: A. Films; C. Electrical properties; C. Optical properties; D. ZnO