

Ga 도핑된 ZnO 박막의 기판에 따른 성장 특성

Effect of substrate on growth of Ga-doped ZnO thin films

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Abstract : In this work, we report the effect of substrate on the growth of Ga-doped ZnO (GZO) thin films. GZO thin films were deposited on various substrates by using pulsed laser deposition (PLD). The structural properties, surface morphologies, and electrical properties were investigated. From the results of HRXRD, *c*-plane (0002) oriented growth of GZO films was confirmed on Al₂O₃ (0001). On the other hand, the GZO films on LAO (100) substrates were grown along the *a*-axis. The obvious differences on the electrical properties of each film were also obtained.

Key Words : Ga-doped ZnO thin films, Pulsed laser deposition

1. Introduction

Transparent conductive oxide (TCO) has been widely used as transparent electrodes in various applications such as liquid crystal displays (LCDs), organic light emitting diodes (OLEDs), and solar cells. So far, indium tin oxide (ITO) is commonly used due to its high visible transmittance and low electrical resistivity. However, ITO is expensive owing to scarcity of indium element. Therefore, Ga-doped ZnO (GZO) has been deeply investigated as alternative TCO materials. In this paper, we report the effect of substrate on the growth of Ga-doped ZnO (GZO) thin films.

2. Experimental and Results

GZO thin films were deposited on various substrates by using pulsed laser deposition (PLD). The structural properties and surface morphologies were determined by using high resolution x-ray diffraction (HRXRD), and atomic force microscopy (AFM), respectively. The electrical properties of each film were investigated by using a Hall measurement system. Generally, GZO films showed *c*-plane preferred orientation due to its lowest surface free energy. However, *a*-plane GZO films were grown on LAO (100) substrates. This could be attributed to the closest lattice mismatch between the *a*-plane (11-20) of GZO and LAO (100) substrates. On the other hand, as expected, *c*-axis oriented growth of GZO films was confirmed on Al₂O₃ (0001). The GZO films on LAO (100) substrates showed higher resistivity than with *c*-plane. The GZO films on LAO (100) and Al₂O₃ (0001) showed a resistivity of $1.0 \times 10^{-3} \Omega\text{cm}$ and $3.3 \times 10^{-4} \Omega\text{cm}$, respectively. The films with *a*-plane and *c*-plane also showed different surface morphologies.

Reference

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