

Measurement of metal atom densities during sputter-deposition of Al-doped ZnO thin films

Ryota Shindo¹, Tadashi Iwata¹, Kazuki Komine¹, Masanori Shinohara¹
and Yoshinobu Matsuda^{2*}

¹*Graduate School of Science and Technology,*

²*Department of Electrical and Electronic Engineering,*

Nagasaki University, Bunkyo 1-14, Nagasaki 852-8521, Japan

**Tel: +81-95-819-2540, Fax: +81-95-819-2540, E-mail: ymat@nagasaki-u.ac.jp*

Abstract

Hollow cathode (HCD) lamp absorption spectroscopy was applied for the density measurement of sputtered Al and Zn atoms in the inductively coupled plasma (ICP) assisted sputter-deposition of Al doped ZnO thin films. The ratio of Zn to Al atom density was one order of magnitude larger or more than the composition ratio of Zn to Al in the sputtering target.

Introduction

We have succeeded in depositing high quality AZO thin films with resistivity of around $10^{-3}\Omega\text{cm}$ by using inductively coupled plasma (ICP) assisted sputtering.[1] To understand the basic mechanism, metal atom densities have been measured by hollow cathode (HCD) lamp absorption spectroscopy.

Experiment and Results

A planar magnetron cathode with a Al-doped ZnO target was used in the experiment. A single turn coil antenna set in between the target and substrate electrodes was used to generate 13.56MHz inductively coupled plasma (ICP). For the density measurements of Al and Zn atoms, hollow cathode (HCD) lamp absorption spectroscopy [2] was applied.

It was found that the Zn density was 10^{11} - 10^{13}cm^{-3} , while the Al density was 10^8 - 10^9cm^{-3} , and the ratio of Zn to Al atom density was one order of magnitude larger or more than the composition ratio of Zn to Al in the sputtering target, suggesting re-evaporation of Zn atoms from inside a vacuum vessel.

This work was supported by Grant-in-Aid for Scientific Research (C) No. 20540485 from Japan Society for the Promotion of Science.

References

- [1] Y. Matsuda et al., Proc. CD of 19th Int. Symp. on Plasma Chemistry, ed. by A. von Keudell, Bochum, July 26 to 31 2009, P2.2.20 (Book of abstracts, p.343).
- [2] S. Takashima, M. Hori, T. Goto, A. Kono, M. Ito, K. Yoneda, Appl. Phys. Lett. 75 (1999) 3929.