

Electrical and optical properties of AZO films sputtered in Ar:H₂ gas RF magnetron sputtering system

Seung-Taek Hwang, Byung-Moon So*, Choon-Bae Park
Wonkwang Univ. WRISS, *Chonbuk National Univ.

Abstract : AZO films were prepared by Ar:H₂ gas RF magnetron sputtering system with a AZO (2wt% Al₂O₃) ceramic target at a low temperature of 100°C. To investigate the influence of H₂ flow ratio on the properties of AZO films, H₂ flow ratio was changed from 0.5% to 2%. As a result, the AZO films deposited with 1% H₂ addition showed electrical properties with a resistivity of $5.06 \times 10^{-3} \Omega \cdot \text{cm}$. The spectrophotometer-measurements showed the transmittance of 86.5% was obtained by the film deposited with H₂ flow ratio of 1% in the range of 940nm for GaAs/GaAlAs LED.

Key Words : AZO films, RF magnetron sputtering, Ar:H₂ gas

1. Introduction

Transparent Conductive Oxide films have been used in a variety of electrical and optical applications such as LED, Solar cell. AZO is emerging as an alternative candidate for ITO films due to its cheap and abundant raw material, nontoxic feature, as well as being easy to fabricate. In this paper, The introduction of H₂ to the process of deposition was carried out to modify the electrical property of AZO films [1-2].

2. Experimental

AZO films were deposited on glass, Si substrate at the pressure of 25 mTorr and temperature of 100°C by Ar:H₂ gas RF magnetron sputtering system using AZO (2wt% Al₂O₃) ceramic target. The H₂/Ar percentage was maintained from 0.5% to 2%. The chamber was evacuated to 8×10^{-6} Torr, and pre-sputtering time was 10 min. The RF power and deposition time were 100W and 2hr. Resistivity, mobility and carrier concentration were measured by Hall Effect and a spectrophotometer was used for measuring transmittances of the films in the wavelength range of 300-1100 nm.

3. Results and discussion

Fig. 1. shows the minimum resistivity of $5.06 \times 10^{-3} \Omega \cdot \text{cm}$ is obtained. The AZO film with resistivity of $5.06 \times 10^{-3} \Omega \cdot \text{cm}$ is suitable to be used as an electrical contact for GaAs/GaAlAs

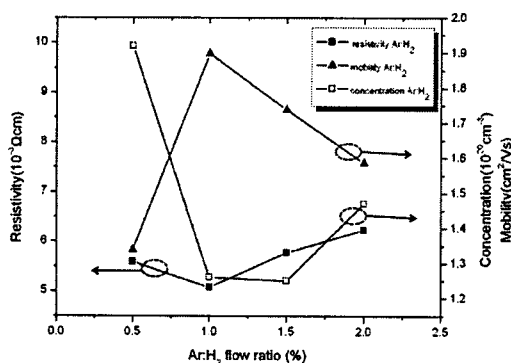


Fig. 1. The electrical properties of AZO films

LED. Fig. 2. shows the transmission spectra of the AZO films prepared with different H₂ flow ratio. For the samples deposited with H₂ flow ratio of 0.5%-2%, the transmittance of 86.5% was obtained by the film deposited with H₂ flow ratio of 1% in the range of 940nm [3].

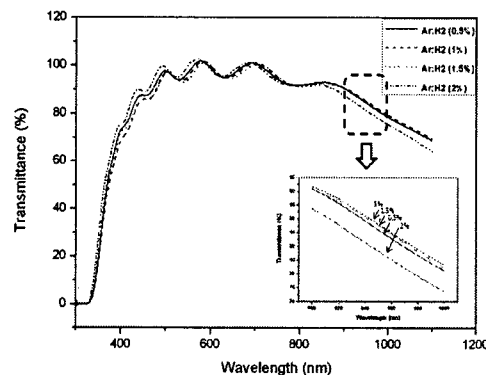


Fig. 2. The transmission spectra of the AZO films

4. Conclusions

The lowest resistivity of $5.06 \times 10^{-3} \Omega \cdot \text{cm}$ and the transmittance of 86.5% in the range of 940nm at Ar:H₂(1%) were obtained for the AZO film deposited by Ar:H₂ gas RF magnetron sputtering system.

Acknowledgements

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