SACPM2015

Contribution ID: **3** Type: **Oral Presentations**

ANOTHER METHOD TO DETERMINE THE REFRACTIVE INDEX OF AlXGa1-XN

Thursday, 7 May 2015 11:20 (20 minutes)

1. Introduction

AlGaN alloys continue to be of great interest due to the application of these alloys in high-power, high-temperature and high-frequency devices such as field-effect transistors, UV-light emitting LED's and laser diodes1-3. A range of different electrical and optical properties can be obtained by varying the alloy composition of AlxGa1-xN by changing the amount of Al in the alloy. The characterization of these alloys to determine the various physical properties as a function of Al content is therefore necessary. Optical characterization is preferred as this technique has the advantage of being non-contact and non-destructive.

In this work, the use of infrared reflection spectroscopy to evaluate AlxGa1-xN epilayers grown with varying Al content by metalorganic vapour phase deposition (MOCVD) on sapphire substrates was investigated. The layer thickness was readily determined using interference fringes in the reflectance spectra of the samples4. However, this requires knowledge of the refractive index n as function of the wavelength. Determination of the refractive index of AlxGa1-xN is challenging, since the refractive index is a function of wavelength and the aluminium content of an AlxGa1-xN sample, as well as the temperature of the sample5. A number of techniques have been reported for the determination of the refractive index for AlxGa1-xN, including from the refractive indexes of AlN and GaN, ellipsometry measurements or Sellmeier type equations6.

The present investigation aims to provide an alternative method to determine the refractive index of AlxGa1-xN at room temperature. The method is based on the manipulation of earlier published experimental results6 (Fig.1) and relations from the slope and y-intercept of straight line graphs. The new formulation was then employed to obtain the thickness of the measured AlxGa1-xN epilayers, using the observed interference fringes (Fig. 2).

1. Results

   `Fig. 1  Examples of straight-line fits of previous results`   `Fig. 2  Interference spectra of two Alx`

   (a) References

2. N. Maeda, T. Saitoh, K. Tsubaki, T. Nishida and N. Kobayashi, Jpn. J. Appl. Physics 38 (1999) L987-L989.
3. T. Takano, Y. Narita, A. Horiuchi and H. Kawanishi, Appl. Phys. Lett. 84 (2004) 3567-3569.
4. J. Han, M.H. Crawford, R.J. Shul, J.J. Figiel, M. Banas, L. Zhang, Y.K. Song, H. Zhou and A.V. Nurmikko, Appl. Phys. Lett. 73 (1998) 1688-1690.
5. F. Reizman, J. Appl. Phys. 36 (1965) 3804
6. U. Tisch, B. Meyler, O. Katz, E. Finkman and J. Salzman, J. Appl. Phys. 89 (2001) 2676-2685.
7. N.A. Sanford, L.H. Robins, A.V. Davydov, A. Shapiro, D.V. Tsvetkov, A.V. Dmitriev, S. Keller, U.K. Mishra and S.P. DenBaars, J. Appl. Phys. 94 (2003) 2980-2991.

Primary author: Prof. ENGELBRECHT, JAA (NMMU)

Co-authors: Ms SEPTHON, B (NMMU); Mr MINNAAR, E (NMMU); Prof. WAGENER, MC (NMMU)

Presenter: Prof. ENGELBRECHT, JAA (NMMU)

Session Classification: Presentations

Track Classification: SACPM