Accepted Manuscript

Origin and effective reduction of inversion domains in aluminum nitride grown by a sublimation method

Keisuke Shigetoh, Kayo Horibuchi, Daisuke Nakamura

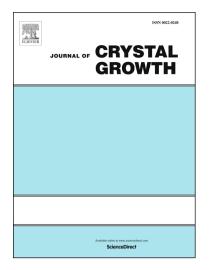
PII: S0022-0248(17)30500-6

DOI: http://dx.doi.org/10.1016/j.jcrysgro.2017.08.016

Reference: CRYS 24267

To appear in: Journal of Crystal Growth

Received Date: 21 April 2017 Revised Date: 10 July 2017 Accepted Date: 10 August 2017



Please cite this article as: K. Shigetoh, K. Horibuchi, D. Nakamura, Origin and effective reduction of inversion domains in aluminum nitride grown by a sublimation method, *Journal of Crystal Growth* (2017), doi: http://dx.doi.org/10.1016/j.jcrysgro.2017.08.016

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.

ACCEPTED MANUSCRIPT

Origin and effective reduction of inversion domains
in aluminum nitride grown by a sublimation method
Keisuke Shigetoh*, Kayo Horibuchi and Daisuke Nakamura
Toyota Central R&D Labs., Inc., 41-1, Yokomichi, Nagakute, Aichi 480-1192, Japan
*E-mail: kei-shigetoh@mosk.tytlabs.co.jp

ABSTRACT

Owing to the large differences in the chemical properties between Al and N polarities in aluminum nitride (AlN), the choice of the polar direction for crystal growth strongly affects not only the quality but also the shape (facet formation) of the grown crystal. In particular, N-polar (0 0 0 -1) has been considered to be a more preferable direction than Al-polar (0 0 0 1) for sublimation growth because compared to Al-polar (0 0 0 1), N-polar (0 0 0 -1) exhibits better stability at high growth rate (high supersaturation) conditions and enables easier lateral enlargement of the crystal. However, some critical growth conditions induce polarity inversion and hinder stable N-polar growth. Furthermore, the origin of the polarity inversion in AlN growth by the sublimation method is still unclear. To ensure stable N-polar growth without polarity inversion, the formation mechanism of the inversion domain during AlN sublimation growth must be elucidated. Therefore, herein, we demonstrate homoepitaxial growth on an N-polar seed and carefully investigate the obtained crystal that shows polarity inversion. Annular bright-field scanning transmission electron microscopy reveals that polarity is completely converted to the Al polarity via the formation of a 30-nm thick mixed polar layer (MPL) just above the seed. Moreover, three-dimensional atom probe tomography shows the segregation of the oxygen impurities in the MPL with a high concentration of about 3 atom%. Finally, by avoiding the incorporation of oxygen impurity into the crystal at the initial stage of the growth, we demonstrate an effective reduction (seven

Download English Version:

https://daneshyari.com/en/article/5489064

Download Persian Version:

https://daneshyari.com/article/5489064

Daneshyari.com