Nanotech

TEM Analysis on AlN Thin Films

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Context

VTT is very active in developing piezoelectric thin films for advanced piezo-MEMS devices. It has been observed that the performance of such films is also highly dependent on the seed layer used and can vary a lot even within the wafer. The reason for this is unclear. Fujita lab has large number of sophisticated characterization tools suitable for evaluation of the crystallography of the films. The topic was found suitable for EUJO-LIMMS project and Tommi Suni from VTT carried out the work in IIS during 2.5 month visit in spring 2014.

Objectives&Methods

The objective is to get better understanding on the growth of the AlN layers. Main area of the interest is near the interface between seed layer and the AlN film. VTT prepared 5 sample wafers having AlN on Si, on high resistivity Si, on two types of Molybdenum layers and on another AlN layer. The wafers were diced to 1 cm x 1 cm chips and focused ion beam (FIB) was used for TEM sample preparation. The TEM sample observation was done using first scanning TEM and then high resolution TEM.

Results

A total of 40 TEM samples were prepared using FIB. From these 20 were characterized using STEM and/or HR-TEM (Figure 1) and total over 500 TEM images were taken. With HR-TEM crystallographic planes on AlN were nicely observed on high magnification images (Figure 2). However, it was impossible to see the interface between the seed layer and the AlN film in high magnification images and therefore crystallographic analysis on the most important region was challenging.

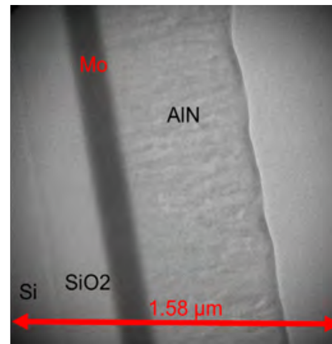

Fig. 1. 10k magnification TEM image of AlN film on molybdenum

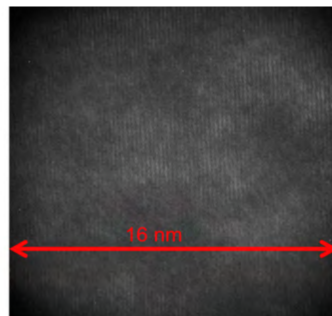

Fig. 2. 1200k magnification TEM image of AlN film on Molybdenum