Contribution ID: **235** Type: **Contributed**

Hetero-epitaxial AlN grown for GaN-power devices

Friday 22 June 2018 10:50 (20 minutes)

Integrated electronic power devices such as HEMTs (high electron mobility transistors) and LEDs are often built of a layer stack of gallium nitride (GaN), aluminium gallium nitride (AlGaN) and/or aluminium indium nitride (AlInN) layers. For the performance of the devices it is essential that such nitride stacks are highly crystalline and defect-free. In order to obtain such perfect structures, suitable substrates or templates are necessary as e.g. silicon carbide, gallium arsenide or aluminium nitride (AlN). AlN templates are typically deposited by metal organic chemical vapor deposition (MOCVD), which is a time- and hence a cost-consuming process.

In the presented work AlN films were prepared on Si(111) by magnetron sputtering using a Clusterline® 200 deposition system from Evatec. Different process parameters such as e.g. film thickness and deposition temperature were varied. A special focus has been set on the interface of Si(111) and AlN and the removal of native oxide on the Si substrates. The effects of the used cleaning procedures wet etching (HF) and plasma etching are compared to each other. The AlN film quality was investigated with X-ray diffraction (XRD), transmission electron microscope (TEM) and atomic force microscopy (AFM) to study the influence of the process parameters on the crystallinity, the lattice constant and the surface roughness.

TEM images show that the AlN films are highly crystalline and form columns with a width of ca. 45nm. This is confirmed by rocking curve (RC) measurements of the AlN(002) diffraction peak that show for 100 nm of AlN on Si(111) a FWHM of less than 1200 arcsec. Increasing the film thickness reduces the amount of defects in AlN and hence the FWHM of AlN(002). Due to the columnar growth the surface roughness increases with thickness. It is shown that the decrease of the FWHM with the thickness is directly correlated to the increasing surface roughness.

The presented results on crystal quality and surface morphology show that AlN films deposited by magnetron sputtering are suitable to replace the MOCVD templates and can serve as buffer layer for HEMT and LED structures.

Author: Dr JAEGER, Dominik (Evatec AG)

Co-authors: Dr ELGHAZZALI, Mohamed (Evatec AG); Dr TSCHIRKY, Thomas (Evatec AG); Dr HEINZ, Bernd (Evatec AG)

Presenter: Dr JAEGER, Dominik (Evatec AG)

Session Classification: Electronic Materials & Processing

Track Classification: Electronic Materials & Processing