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Characterization of Thin Gallium Nitride Films on Polyimide Substrates by Ion-Beam assisted Deposition.

ABSTRACT - Masterthesis

The motivation to work on GaN semiconductor is due to its important technological applications. Light emitting devices made by GaN acts in the full range of visible spectrum. The work describes about the growth of thin gallium nitride (GaN) layers on polyimide substrates in an ion beam assisted deposition process (IBAD) using nitrogen ions with hyper thermal energies.

In the beginning the material systems GaN and polyimide are illuminated by a theoretical introduction to the basic principles of thin film formation. There by the thermodynamic basis and kinetic growth models are described. The IBAD process is explained and thus compared to the other common used deposition techniques for GaN layers like Metal Organic Vapour Phase Epitaxy (MOVPE) or Hydride Vapour Phase Epitaxy (HVPE). The entire experiment is done by following the description of the analysis methods like Reflection of High Energy Electron Diffraction (RHEED), Auger Electron Microscopy (AES), X-Ray Diffraction (XRD), and Scanning Electron Microscopy (SEM).

Later, GaN layers are deposited on thin Kapton substrates in an IBAD process system, by varying especially the substrate temperature, effusion cell temperature and nitridation time during the deposition. The resulting substrate temperature and film thickness are investigated by using various analysis methods.

On the other hand, it is shown that the measured scale of the surface topography does not depend upon the layer thickness. In conclusion the crystalline structure and texture are drawn from XRD and RHEED measurements. It is depicted that the GaN layers are crystalline and grow preferably c-axis oriented, independent of layer thickness and substrate temperature during the deposition.