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Sandwich method to grow high quality AlN by MOCVD

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The UV capabilities of III-nitride materials are of special interest for civilian applications such as air and water sterilization, efficient white lighting, high density optical data storage and military applications such as biological agent detection and non-line-of-sight communication etc. In recent years AlN has received a great deal of attention for use as a template layer for deep UV emitter and detector applications because of its promising features such as UV transparency, good thermal stability and high thermal conductivity. Generally, the surface morphology and defect density of AlGaN and the upper quantum-well active layer of DUV devices depend significantly on the crystalline quality of the underlying AlN template; therefore, obtaining AlN with a smooth surface and low threading dislocation (TD) density is critical to improve DUV device performance. In this study we report pulsed atomic layer epitaxy growth of high crystalline quality, thick (~2μm) and crack-free AlN material on c-sapphire substrates via a sandwich method using metal organic chemical vapor deposition. This method involves the introduction of a relatively low temperature (1050 °C) 1500 nm thick AlN layer between two 250 nm thick AlN layers which are grown at higher temperature (1170 °C). The surface morphology and crystalline quality remarkably improve using this sandwich method. A 2 μm thick AlN layer was realized with 33 arcsec and 136 arcsec FWHM values for symmetric (0002) and asymmetric (10-15) reflections of ω-scan, respectively, and it has an root-mean square surface roughness of ~0.71 nm for a 5 x 5 um^2 surface area.

Biography

I Demir received his PhD degree in Solid State Physics from the Cumhuriyet University, Turkey. During his PhD studies he worked at Center for Quantum Devices-Northwestern University USA under the supervision of Prof. Dr. Manijeh Razeghi. Currently, he is a research assistant at Nanophotonics Research and Application Center at Cumhuriyet University. His research interest covers high quality III-V semiconductor thin films (InGaAs, InAlAs, InP, AlN, AlGaN, GaN etc) growth by MOCVD and detailed characterization to produce electronic and optoelectronic devices.

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