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Cantilever Epitaxy of AlN using Hydride Vapor Phase Epitaxy
SCOTT A. NEWMAN, DERRICK S. KAMBER, YUAN WU, EDWARD LETTS, STEVEN P. DENBAARS, JAMES S. SPECK, SHUJI NAKAMURA, Materials Department, Electrical Engineering Department, NICP/ERATO JST, University of California, Santa Barbara, 93106 — AlN is an important material for AlGaN-based electronic and optoelectronic devices such as UV Light Emitting Diodes and High Electron Mobility Transistors. We have grown AlN films with reduced Threading Dislocation (TD) densities using Cantilever Epitaxy with the Hydride Vapor Phase Epitaxy growth method. Prior to growth, 6H-SiC substrates were processed using standard lithography and ICP etching to form periodic ridge/trench patterns. Ridges were oriented in the $\langle 1\bar{1}00\rangle_{SiC}$ direction, and trenches were etched up to 12.6 μm deep. AlN was grown laterally from 2-4 μm wide ridges over 3-6 μm wide trenches and coalesced. Plan-view TEM analysis showed that TD densities in the wing regions were less than 8.3 x 10^6 cm^{-2} as compared to 3.9 x 10^9 in the seed regions. The TDs are predominantly edge-type with $\mathbf{b} = \frac{1}{3}\langle 11\bar{2}0\rangle$. Most of these TDs originate from the AlN-SiC interfaces on the tops of the ridges and propagate vertically. A small number of inclined dislocations propagate into the wing region.

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