

Abnormal Behavior of MOCVD Grown $\text{Al}_x\text{In}_{1-x}\text{N}$ Observed by Various Material Characterizations

Roy Byung-Kyu Chung[†], Steven P. DenBaars, James S. Speck, Shuji Nakamura

University of California Santa Barbara
(roychung@engineering.ucsb.edu[†])

AlInN has been studied extensively over the past few years due to its interesting material properties that are not present in other ternary nitrides. However, basic material study of AlInN has not been reported as much compared to device applications due to the difficulty in the growth. We have performed the material studies from various aspects. A secondary ion mass spectrometry (SIMS) has shown high oxygen content above $1 \times 10^{18} \text{ cm}^{-3}$ with its insensitivity to the growth conditions. While the free carrier concentration observed by the capacitance-voltage (C-V) measurements was about $3 \times 10^{17} \text{ cm}^{-3}$, the activation energy measured by temperature dependent C-V was only about 4 meV. Si doped AlInN (Si level $\sim 2 \times 10^{18} \text{ cm}^{-3}$) showed almost no carrier freeze-out at carrier density of $1 \times 10^{18} \text{ cm}^{-3}$. More studies were carried out with a transmission electron microscopy, time-resolved photoluminescence and other analytical techniques to understand the results from SIMS and C-V studies. In this report, we will discuss the possible correlations between the abnormal characteristics in AlInN .

Keywords: AlInN , MOCVD, Characterizations