

Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Imaging surface states of GaN(000 $\bar{1}$) at low temperatures¹

DANDA P. ACHARYA, KENDAL CLARK, MUHAMMAD B. HAIDER, ARTHUR R. SMITH, NANCY SANDLER, SAW-WAI HLA, Ohio University — It is known that the surface layer of nitrogen polar gallium-rich GaN (000 $\bar{1}$) is semi-metallic in contrast to the bulk GaN. Such semi-metallic behavior is predicted to be contributed by surface state bands [1]. Here, we are able to image two of the surface states associated with the GaN (000 $\bar{1}$) surface for the first time at liquid helium temperatures using a low-temperature scanning tunneling microscope (LT-STM). The samples, GaN(000 $\bar{1}$), are grown on sapphire (0001) substrates at sample temperature of 650 °C using r.f. N-plasma molecular beam epitaxy. The freshly grown samples are then transferred to LT-STM system in an ultrahigh vacuum environment for direct investigations. The voltage dependent STM images clearly reveal novel surface features associated with these structures, which are further confirmed by tunneling spectroscopy measurements. This work is financially supported by a NSF-NIRT grant, DMR-0304314. (NIRT collaboration). [1] J. Vac. Sci. Technol. B 16(4), 2241 (1998)

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Date submitted: 05 Dec 2005

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