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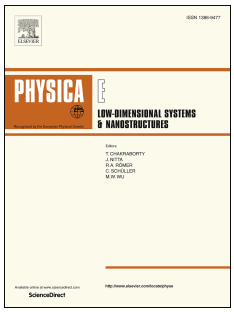

C-DLTS interface defects in $Al_{0.22}Ga_{0.78}N$/GaN HEMTs on SiC: Spatial location of E2 traps

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C-DLTS Interface Defects in $Al_{0.22}Ga_{0.78}N$/GaN HEMTs on SiC: Spatial location of E2 traps

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Abstract

The purpose of this paper has focused on the investigation of the High electron mobility transistors AlGaN/GaN HEMTs based on SiC substrates by means of capacitance-voltage-temperature (C-V-T) and Deep Level Transient Spectroscopy (DLTS). The C-V analysis have been recorded in the 20-320K temperature range and exhibit an increase in the pinch-off voltage by an amount of 300mV once the temperature exceeds 200K. A hysteresis phenomenon has been observed in the C-V spectra by sweeping the gate voltage Vgs forth and back between -5 and 0V. This parasitic effect has identified to be related to trapping and detrapping mechanisms occurring in the GaN-HEMT device. DLTS results have proved the presence of two traps, labeled E1 and E2, with activation energies of 0.31eV and 0.525eV and capture cross sections of $3.86\times10^{-18}cm^2$ and $2.75\times10^{-15}cm^2$, respectively. The major E2 trap seems to be nitrogen anti-sites, possibly located in the buffer layer near to the interface AlGaN/GaN. It has been reported that there exists a good correlation betwixt the anomalies in C-V-T characteristics and DLTS measurements.

Keywords: Hysteresis effect, AlGaN/GaN HEMT, Interface Defects, DLTS.

1. Introduction

Gallium nitride (GaN) is still one of the most attractive and promising wide band gap materials having umpteen applications in the microelectronics and optoelectronics fields. The tremendous properties of GaN based electronic devices [1-5] render this powerful material