Frequency Dependent Capacitance and Conductance–Voltage Characteristics of Nitride GaAs Schottky Diode

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A nitride GaAs Schottky diode have been fabricated by nitridation of GaAs substrates with thickness 0.7 nm of GaN layer. The capacitance–voltage $C(V)$ and conductance–voltage G/ω versus V of the Au|GaN|GaAs structures were investigated at room temperature for different frequencies ranging between 1 KHz and 1 MHz. The measurements of $C(V)$ and G/ω versus V of the Au|GaN|GaAs Schottky diode were found to be strongly dependent on bias voltage and frequency. The capacitance and conductance increased significantly with decreasing of the frequency, indicating the presence of continuous interface state density behavior. The series resistance $R_s(V)$ plot gives a peak, decreasing with increasing frequencies and almost constant for high frequency. The device parameters such as doping concentration, interface capacitance, the barrier height, and series resistance were calculated using $C(V)$ and $G(V)$ characteristics, and were found to be $1.3 \cdot 10^{16}\,\mathrm{cm}^{-3}$, $3 \cdot 10^{-7}$ F, 1.8 eV, and 47 Ω, respectively. The frequency dependency of the interface states density was calculated using Hill–Coleman's technique and it has been shown that the interface states density exponentially decreases with increasing frequency from $10^{16}\,\mathrm{eV}^{-1}\mathrm{cm}^{-2}$ for 1 KHz to $10^{13}\,\mathrm{eV}^{-1}\mathrm{cm}^{-2}$ for 1 MHz.

Keywords: Schottky, GaAs, $C(V)$, $G(V)$, nitridation.

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