Current–Voltage, Capacitance–Voltage–Temperature, and DLTS Studies of Ni|$6H$-SiC Schottky Diode

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In this paper, we give a systematical description of Ni|6H-SiC Schottky diode by current–voltage $I(V)$ characteristics at room temperature and capacitance–voltage $C(V)$ characteristics at various frequencies ($10-800$ kHz) and various temperatures ($77-350^\circ$K). The $I(V)$ characteristics show a double-barrier phenomenon, which gives a low and high barrier height ($\phi_{bn}^{\mathrm{L}} = 0.91$ eV, $\phi_{bn}^{\mathrm{H}} = 1.55$ eV), with a difference of $\Delta\phi_{bn} = 0.64$ eV. Also, low ideality factor $n^{\mathrm{L}} = 1.94$ and high ideality factor $n^{\mathrm{H}} = 1.22$ are obtained. The $C-V-T$ measurements show that the barrier height ϕ_{bn} decreases with decreasing of temperature and gives a temperature coefficient $\alpha = 1.0 \cdot 10^{-3}$ eV/K and $\phi_{bn}(T = 0\,\mathrm{K}) = 1.32$ eV. Deep-level transient spectroscopy (DLTS) has been used to investigate deep levels in the Ni|6H-SiC Schottky diode. The traps signatures such as activation energies $E_a = 0.50 \pm 0.07$ eV, capture cross-section $\sigma = 1.8 \cdot 10^{-20}$ cm^2, and defect concentration $N_{\mathrm{T}} = 6.2 \cdot 10^{13}$ cm^{-3} were calculated from Arrhenius plots.

Keywords: si1licon carbide, Schottky diodes, $I-V$, $C-V-T$, deep-level transient spectroscopy (DLTS).

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