

# Deep traps and temperature effects on the capacitance of p-type Si-doped GaAs Schottky diodes on (211) and (311) oriented GaAs substrates

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## Abstract

The SILVACO-TCAD numerical simulator is used to explain the effect of different types of deep levels on the temperature dependence of the capacitance of p-type Si-doped GaAs Schottky diodes grown on high index GaAs substrates, namely (311)A and (211)A oriented GaAs substrates. For the (311)A diodes, the measured capacitance-temperature characteristics at different reverse biases show a large peak while the (211)A devices display a much smaller one. This peak is related to the presence of different types of deep levels in the two structures. These deep levels are characterized by the Deep Level Transient Spectroscopy (DLTS) technique. In the (311)A structure only majority deep levels (hole deep levels) were observed while both majority and minority deep levels were present in the (211)A diodes. The simulation software, which calculates the capacitance-voltage and the capacitance-temperature characteristics in the absence and presence of different types of deep levels, agrees well with the experimentally observed behavior of the capacitance-temperature properties. A further evidence to confirm that deep levels are responsible for the observed phenomenon is provided by a simulation of the capacitance-temperature characteristics as a function of the ac-signal frequency.

## Keywords:

High index GaAs

Capacitance-temperature

Deep levels

SILVACO simulation