SIMULATION OF LOW-TEMPERATURE CURRENT FLOW AND SENSITIVITY IN Si DIODE TEMPERATURE SENSORS

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S u m m a r y

Current-voltage characteristics and temperature response curves of silicon diode temperature sensors were investigated at low temperatures. The proposed theoretical model of the low-temperature current flow in $n^{++} - p^{+}$ diode structures takes into account the mechanism of non-Ohmic conductivity with variable-range-hopping in the range of a diode base and the tunneling current through a potential heterojunction barrier. Such a heterojunction is formed due to the asymmetric narrowing of a forbidden gap in the n^{++} and p^{+} regions, induced by the high and different doping levels of the emitter and the base of diode. The found dependences of the parameters of non-Ohmic hopping conductivity upon the temperature and the electric field, have allowed us to explain the observed features of diode sensor sensitivity in the range of helium temperatures.