EFFECT OF GAMMA-IRRADIATION ON THE ELECTRICAL PROPERTIES OF UNIPOLAR DIRECTLY BONDED p-Si/p-Si JUNCTIONS

V. A. Stuchinsky and G. N. Kamaev
Institute of Semiconductor Physics
Lavrent'ev Ave 13
Novosibirsk 630090, Russia
V. V. Bolotov and Yu. A. Sten'kin
Institute of Sensor Microelectronics
Prosp. Mira 55a
Omsk 644077, Russia

Electrical properties of unipolar directly bonded p-Si/p-Si junctions irradiated with Co^{60} gamma-quanta up to a dose of 150 Mrad have been studied for the first time using the characterization procedure recently proposed by two of the present authors in (1, 2) and further improved in (3). At a fixed bias voltage, the density of the direct current across the structure is shown to increase with the dose of gamma-quanta. Possible reasons for this increase are discussed in terms of irradiation-induced changes in the energy distribution of electronic states at the bonded interface, doping concentration in the vicinity of this interface, generation/recombination rate of charge carriers in the interfacial space-charge region, and density of interfacial-barrier punctures. The current through the punctures in the initial junction is shown to contribute predominantly to the total current across the structure, exceeding the current across the areal part of the junction with the barrier, and this contribution increases with the total flux of gamma-quanta given to the sample. The spreading resistance of the system of interfacial punctures decreases from 5.8-1.4 kOhm/cm^2 (for bias voltages ranging from 3 to 7 V) in initial structures to 150-130 Ohm/cm^2 in structures irradiated with a dose of 50 Mrad of gamma-quanta. At the same time, the energy distribution of interface states on the areal part of the structure with the barrier changes rather insignificantly. These data strongly suggest that the interfacial barrier decreases rather non-uniformly over the junction area with the dose of irradiation, with the emergence of additional barrier punctures at the bonded interface. The most likely reason for that is enhanced generation rate of minority carriers in the interfacial depleted region of irradiated structure. The enhanced generation of carriers in the irradiated semiconductor results in an increased flux of minorities onto interfacial states, causing a decrease in the trapped interfacial charge and, as a result, an increase in the leakage current through interfacial punctures.

REFERENCES

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