Effects of charging at impact of plasma on structures type «microconductor on an insulator» in plasma processing technologies

V.P. Tarakanov\* and E.G. Shustin

Kotelnikov Institute of Radio Engineering and Electronics Russian Academy of Sciences,
 Fryazino, Russia
\*Joint Institute of High Temperatures Russian Academy of Sciences, Moscow, Russia

At creating nanoelectronic devices conventional plasma technologies are faced with the inevitable problems including increasing role of the accumulation of a charge on the surface under treatment. Understanding the effect of surface charging on the process of plasma action and on the resulting topology of structures on the nanometer scale is a key to achieving required level of accuracy and quality of functional features of the devices.

In this paper we present the results of computer simulation of the effect of charge accumulation to features of plasma action to structure "a conductor on an insulator." The simulation was carried out with use of the KARAT code, applying a mathematical model based on Maxwell equations with the various material equations. An important feature of the model developed for this problem is that the transverse dimension of the conductor is much smaller than the Debye radius of the surrounding plasma. The developed algorithmic model makes it possible to observe how spatial and energy distribution of ions bombarding the conductor are transformed with the accumulation of charge on the surrounding dielectric.

Calculations have shown that the ion beam appears to be not only strongly non-uniform on the cathode width (the beam width makes 0.2 of width of the cathode), but also much spread over arrival angles on the cathode. These effects define heterogeneity of etching of the conductor. The ion stream goes also to a dielectric surface, in the nearest vicinity of the cathode its density by 2 orders of quantity, and energy by 3 times are lower, than on the cathode.

Though in this report the qualitative results received for calculation with conditional parameters of system are presented, the model allows performing quantitative modeling of a situation in actual practice of the plasma reactor, including at pulse modulation of parameters of plasma.

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