THEORETICAL AND EXPERIMENTAL STUDY OF MULTIPACTOR DISCHARGE ON A DIELECTRIC

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A review of theoretical and experimental studies of secondary electron emission discharge (multipactor) on a dielectric is presented. The coefficient of microwave power absorption by a single-surface multipactor on a dielectric is studied analytically and numerically as a function of the incident microwave power [1]. An analytical expression for the coefficient of microwave power absorption is derived for the case of normal incidence of microwave radiation on the dielectric under the conditions in which the electron oscillation energy εosc in the microwave field is much larger than the first crossover energy ε1 for the secondary electron yield from the dielectric surface (εosc >> ε1):

 , (1)

where *T* is the temperature of emitted electrons. Numerical simulations have shown that, in the presence of electron reflections from the dielectric surface at a level of 10%, the absorption coefficient increases by one order of magnitude compared to formula (1).

The coefficient of microwave power absorption κ by a multipactor discharge on a LiF monocrystall in a waveguide is measured experimentally [1]. The measred value κ ≈ 1.5% agrees with results of numerical simulations obtained under the assumption that elastic and inelastic reflections from the crystal surface are at a level of 10%.

The dependence of the micowave power absorbed by a multipactor on the incidence angle of microwave radiation is studied numerically and analytically [2]. It is shown that, under grazing incidence of microwave radiation on the dielectric surface, when the wave electric field **Е**0 is nearly perpendicular to the dielectric surface, the ratio of the absorbed microwave power per init area of the dielectric surface to the microwave power flux density is

 . (2)

In the case of oblique incidence, the microwave power absorbed per unit area of the dielectric surface has a minimum at the incidence angle of α ≈ (*T*/ε1)1/2 < 1.

Two-dimensional particle-in-cell simulations of a multipactor discharge on a dielectric in a plane-parallel waveguide are performed [3]. It is shown that, at a sufficiently high microwave field, a combined multipactor discharge develops in the waveguide: a single-surface multipactor on the dielectric and a two-surface multipactor between the waveguide walls. In this case, the single-surface multipactor on the dielectric accelerates the development of the two-surface multipactor, serving as a source of seed electrons for the latter.

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References

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