

INFLUENCE OF THE MICROWAVE MAGNETIC FIELD ON HIGH POWER MICROWAVE WINDOW BREAKDOWN

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Effects of the microwave magnetic field on window breakdown are investigated at the upstream and downstream side of a dielectric interface. Simple trajectory calculations of secondary electrons in and rf field show significant forward motion of electrons parallel to the microwave direction of propagation. The Lorentz-force due to the microwave magnetic field on high-energy secondary electrons might significantly influence the standard multipactor mechanism. As a result, the breakdown power level for the downstream side of a window would be higher than for the upstream side. This hypothesis was tested utilizing an S-band traveling wave resonant ring, powered by a 3 MW magnetron at 2.85 GHz, leading to a total power greater than 60 MW. Breakdown was studied on an interface geometry consisting of a thin alumina slab in the waveguide, oriented normal to the microwave propagation direction. Two field enhancement tips are placed in the middle of the broad waveguide wall on the slab surface, either in downstream or in upstream direction. This ensures an almost purely tangential electric field at the interface surface and a localized breakdown. Diagnostics include local field probes, forward and reverse power probes, high speed (5 ns exposure time) imaging, and x-ray imaging. Preliminary results show an increase in the breakdown field amplitude on the downstream surface as compared to the upstream surface. X-ray imaging shows a distributed x-ray source located between the field enhancement tips, with several keV quantum energy of the emitted x-rays. The intensity and spatial resolution of these preliminary measurements, however, is not sufficient to reveal differences for the upstream and downstream direction. Still, the observed higher necessary power for downstream breakdown, and the existence of high energy electrons, confirm the hypothesis of the influence of the microwave Lorentz-force on breakdown and multipactoring.

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