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Modeling of oblique ionization front propagation in high power millimeter wave field TENSEI TAKEICHI, TOSHIKAZU YAMAGUCHI, MASAFUMI FUKUNARI, HIROYUKI KOIZUMI, KIMIYA KOMURASAKI, YOSHIHIRO ARAKAWA, The University of Tokyo — High power millimeter-wave discharge in atmospheric air is characterized by filamentary structure and a supersonic propagation of the ionization front, driving a shockwave. In this research, the filamentary plasma structure was studied experimentally, using a 170 GHz gyrotron at power range of 200 kW to 600 kW, and numerically. About the ionization front propagation process, it is important to investigate steady plasma formation process, in a filamentary form, through millimeter wave. Each filamentary element is formed by granular plasmoids not propagating along or perpendicularly to the electric field, but obliquely to the field. To solve this mechanism, 2-dimensional numerical analysis was conducted using plasma fluid model. In dozens of times the size of plasma element scale, the steady plasma structure formation was simulated, and the calculation results were compared with previous experimental results. The calculated formation patterns were in good qualitative agreement with experiments. However, the ionization front velocity in the simulation is much higher than the experimental result. Thus, appropriate ionization model for the simulation is needed to get a better agreement. Moreover, for a quantitative agreement, not only the ionization model but also consideration of 3-dimensional effects is necessary, since 2-dimensional simulation cannot estimate accurate wave reflection and interaction with the filamentary plasma.

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