MODE SWITCHING IN THE A6 MAGNETRON*

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The possibility of using an external RF signal to rapidly switch the operating mode in relativistic magnetrons is studied using the PIC code MAGIC[1] for the A6 magnetron[2] operating at 360 kV with anode block radius R_a = 2.11 cm. In the A6 magnetron with asymmetric extraction of radiation only nondegenerate modes (π–mode and the 2π–mode) can be used as the operating mode. Mode hopping to any neighboring mode leads to magnetron operation with an unloaded mode, resulting in overheating and erosion of its electrodes.

We show that for the A6 magnetron driven by an ordinary solid cathode stable 2π–mode generation occurs in a narrow gap $\Delta \le 0.53$ cm between the anode and cathode, whereas π–mode generation occurs when $\Delta \ge 1.11$ cm; mode competition takes place for any magnetic field when the cathode radius R_c is $1.58 > R_c(\text{cm}) > 1.0$ and the minimum input RF signal 200 MW switching the operating modes is for $R_c \approx 1.3$ cm. For the transparent cathode[3] the interval of cathode radii where mode competition takes place is very small, $1.48 > R_c(\text{cm}) > 1.38$, and the minimum power of the external signal for switching is about two orders of magnitude less.

The external RF signal expands the region of applied axial magnetic field for cathode radii where pure operating modes are generated. In this case, RF priming[4] takes place even when the frequency of the input signal is different from that of the operating wave.

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