INFLUENCE OF THE OUTPUT COUPLING ON FREQUENCY SHIFT AND MODE COMPETITION OF THE A6 MAGNETRON

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In this work, we study the pulling effect of the A6 magnetron using a conformal finite-difference time-domain (CFDTD) method as implemented in VORPAL [1]. We can accurately calculate the frequency shifts of the A6 magnetron due to the pulling effect of the output loading and also study the resulting mode competition. A tapered output waveguide and a coupling slot have been added to the A6 magnetron and the perfectly matching layer (PML) boundary condition has been successfully applied at the output of the waveguide. Here, we use a mesh grid of 100×100 with Dey-Mittra technique [2, 3] and a total simulation time up to 1000 ns so that we can preserve the frequency accuracy of 99.8% for the model [4]. The pulling effect can be studied via measuring the frequency shift of the constructed model with the loading changed by varying the size of the coupling slot, i.e., changing the slot coupling. The cases of the slot coupling angle Ψ equal to 0.5, 1, 2, 4, 8 and 16 Degrees are simulated. The simulation results show that the frequency spectra are very sensitive to the strength of the output coupling. The frequencies of some modes are shifted due to the coupling and some mode destruction has been observed. It is found that the resonance peak of the π mode is very weak in the case of Ψ=4 Degrees and disappears in the cases corresponding to larger coupling angles. However, the resonance peak of the 2π mode exits in all of the cases and is more robust compared to the π mode resonance. The resonances of both π and 2π modes are blue shifted, i.e., shifted to the higher frequency regime. By comparison, the frequency shift of the π mode is larger than that of the 2π mode. Based on these simulation results, we can conclude that the waveguide coupling of the A6 magnetron is unfavorable to the π mode oscillation. However, the 2π mode oscillation is not too sensitive to the waveguide coupling as the π mode does. This could possibly explain why the operation of the A6 magnetron favors the 2π mode.

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