

A REVIEW OF HIGH-FREQUENCY MAGNETRON

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Abstract

Radiofrequency vacuum electronic devices" (RF VEDs) have been a promising achievement in radio-wave and microwave age for quite a long time. With advancements, the VEDs are currently making a beeline for higher frequency model viz. milli-meter (mm) wave and Terahertz (THz) with considerable power. The incited systems, ad libs, and upgrades, especially in magnetrons, have been significant for pushing the pre-requisites of advanced high frequency application. The paper presently places an audit with regards to the different methods, structures, and advancements proposed and executed to reassert the reasonableness of magnetrons as a promising agent of VEDs for mm and THz radiation age. Execution parameters like power, working frequency, productivity, and so forth serve to inspect the advancement patterns of mm and THz magnetrons. This paper presents electromagnetic structure of the coaxial pit for high power X-band coaxial magnetron

Keywords: Coaxial Cavity, L-Band, Particle-In-Cell (PIC), S-Band, Sulphur Hexafluoride (SF6), LINACs.

I. INTRODUCTION

Magnetron is considered as a "vacuum tube microwave oscillator" has been famous since "World War II". Despite the fact that, being perhaps the most energetic individual from microwave tube family, the universality of magnetron is immaculate as it has applications in various locales i.e., radars, mechanical warming, broilers, microwave faltering, likewise straight accelerator(LINACs) [1]. LINACs are by and large used in remedial, cargo checking, and atom asks about applications. LINACs make high imperativeness X-radiates, used in radiotherapy.

High essentialness X-radiates is good for pulverizing illness tumours. A massive flood is found in the zone of sickness acknowledgment in making countries e.g., India, ringing around 1,000,000 infection patients consistently [2]. For the present circumstance, remedial LINACs



are needed to be decreased in size and modest. LINACs require microwave tube as a RF source to animate electron pillar. Thusly, magnetron is basic for therapeutic LINAC applications as it is acclaimed for insignificant exertion, high capability, and moderate arrangement.

Rhythmic movement investigate are continuing to make X-band LINACs diminished and light weight. Such a LINAC system requires high control RF source at 9.3 GHz. Albeit high force magnetrons in lower recurrence gatherings (L-band, S-band) have been represented recorded as a hard copy and monetarily open (MG5125X e2v tech.), in the X-band, magnetron passing on only up to 1.5 MW top force is mechanically available (VMX3095cpi) [3]. All things considered, X-band magnetrons use WR90 or WR112 standard rectangular assistants in the yield fragment. Nitrogen (N2) or then again sulphur hexafluoride (SF6) gases at high weight are used to improve the force dealing with breaking point of waveguides for working in high zenith control (in MWs). Coaxial magnetrons are supported in high recurrence ranges when stood out from customary magnetrons. Coaxial magnetron was made to vanquish the obstacles of standard magnetron to the extent execution, for instance, yield control and working recurrence band. On the off chance that there ought to be an event of common melancholy magnetron, estimations, decreasing at high working frequencies achieve inferior quality factor (Q). Additionally, tying constructs RF hardships similarly as breakdown at high recurrence reach out in conventional magnetrons. Coaxial magnetron doesn't need tying [4]. Outside opening with high Q is in addition familiar coaxially with anode opening in coaxial magnetron.

Design Cavity Parameters:

As this mode has high vitality stockpiling, coaxial depression can essentially be intended for TE011 mode operation. In TE011 mode, azimuthally electric field is available, which gets greater in the middle and also evaporates external coaxial depression dividers at the inside. Inside the implied coaxial pit sits the Anode pit structure. In the coaxial pit, the bearing of the electric field would be the same as in the operating π -mode of the anode pit replacement resonator. It should be possible to successfully mask the undesired strategies of the coaxial pit by placing an attenuator [5]. Additionally, TE011 allows solid mechanical tuning.

There are three dimensions of a coaxial cavity, i.e., internal range (an), outward sweep (b), and duration (l). By shortening the two sections of the beam gain axis, the coaxial hole may be formed.

Demonstration on Particle-In-Cell (Pic):

The early work conducted by Benemann and Dawson may be accompanied by the cause of the Particle-In-Cell (PIC) technique used to replicate fewer plasmas in the collision. Space charge forces were integrated by means of direct arrangement of Coulomb's law in these important material science models, and charged molecule instructions were recorded in occasional structures [6]. The passage of 100-1000 particles and even the collaborations



between them were included in the primary PIC re-enactments. PIC codes will re-enact 104-1011 particles these days.

The PIC code re-enacts the motion of plasma particles and ascertains from the position and speed of these particles all macro quantities (such as thickness, current thickness, and conveyance capacities). This is a numerical technique that can be used through a take-off from the warm balance to re-enact plasmas, tenuous gases, sub-atomic gas components and distinct systems. The gas is spoken to by different macro particles in the PIC technique that travel in a space represented by a computational task. Whenever every molecule is placed within a functioning cell, its name is given to the technique. From the field conditions, the macro-force following up on the particles is measured. The phrase "Particle-in Cell" begins with the manner in which the particles of leisure are dulled out in full size amounts.

PIC codes are typically structured depending on the code's dimensionality and the configuration of the conditions used by Maxwell. The electromagnetic codes settle the whole structure of the circumstances of Maxwell, while the electrostatic codes grasp only the situation of Poisson [7]. The direction and velocity of particles are characterised in continuum space in the PIC method, while fields are characterised in isolated regions in space. The two fields and particles are characterised on distinct times, be that as it might. With the transient plan, the position and speed of the molecule and field projections are advanced consecutively in time, starting from introductory conditions.

The Boundary Conditions of Molecule:

There are two kinds of limit conditions, to be explicit radiation and ingestion. As far as possible condition, is used basically at the cathode surface of the contraption and in areas inclined to electron outpouring, for instance, the finder. Transmission from surface of materials depends on different boundaries, for instance, voltage level and temperature, and this subject is a functioning region of examination.

The subsequent atom limit condition for re-authorization is a magnificently retaining limit. This cut-off condition is routinely applied to surfaces that are also immaculately directing metal cut-off points for the field game plans [8]. For the present circumstance the particles are discarded right when experience the breaking point and weighting the current conveyed by these particles is stopped. Notwithstanding the way that this condition routinely happens before long, anyway the actual authenticity of the present situation is increasingly scrappy and every now and again brings about difficulties in seeing all the current courses in the resonctioning.

The Particle-in-cell (PIC) based MAGIC programming gadget has been used in this suggestion for re-enacting the magnetron. One of the objectives is to use the gadget for execution gauges which could then incite the decision of a redesigned calculation. This item is a settled in financially available electromagnetic structure gadget in the plasma, microwave, and beat control organizations [9]. Charm is a two-and three-dimensional client configurable mathematical re-institution code that self-dependably comprehends the full plan of time



subordinate Maxwell's conditions and the absolute Lorentz power condition to give the correspondence between space charges and electromagnetic fields.

Three-dimensional restricted distinction time-space electromagnetic computations are joined with particle in-cell approaches to manage give snappy, exact, time-subordinate assessments of the fields and atom development in stage space. The use of numerous computational and entertainment programmes such as MAGIC is important because rational plans for tangled models and calculations are not normally practicable or even serviceable. Charm is a viable programming in understanding states of development for particles in electromagnetic fields since it joins the most important frameworks and takes into clarification arrangements to meet a customer's specific requirements with least effort [10].

II. CONCLUSION

The key relativistic magnetron dreamed at MIT in the 1970s with the potential to produce power in the Megawatt run was the A6 magnetron with outspread yield and uniform discharge tube-shaped cathode (i.e. "solid cathode"). The firing time and production of solid cathode microwave motions in magnetrons is highly mild. Therefore, the "transparent cathode" was proposed as a way of enhancing the general execution of relativistic magnetron A6 and decreasing the starting time of movements, which can prompt fast beats for ultrawideband applications. Another important class of relativistic magnetrons that has recently been suggested is magnetrons with diffraction yield. In pivotal diffraction yield magnetrons, while most relativistic magnetrons detach the yield control radially from a gap centred in their pits, the radiation is pivotally separated by means of a horn receiving system or different waveguides along the vanes of the anode square.

The Particle-in-Cell (PIC) code reproduces the passage of plasma particles and defines the direction and velocity of these particles in a single full scale quantity. In this postulation, the molecule in-cell Enchantment programming tool was used for magnetron show and reproduction to get the enhanced geometry based on the execution of the gadget.

III. REFERENCES

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