Design of a MW Level 2nd Harmonic Coaxial Gyrotron Cavity with Variable Corrugation Depth of the Inner Conductor

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ABSTRACT

The demand for high-power gyrotrons at frequencies above 200 GHz is increasing. This is anticipated to provoke a growing interest in harmonic high-power gyrotrons. Interacting with the second cyclotron harmonic facilitates a doubling of the output frequency in gyro-devices using the same magnet system. Since the coupling of the electron beam with TE modes becomes inherently weaker, with increasing harmonic number, a suitable method must be found to suppress fundamental frequency modes. The use of impedance corrugated inserts in coaxial gyrotron cavities has been presented in this regard [1-3].
In a coaxial gyrotron, the cavity mode's eigenvalue, and hence its cutoff frequency and diffractive quality factor of the cavity, depends on both the ratio of the outer to inner wall radius and the depth of the surface impedance corrugations on the inner conductor [4]. In this way, fundamental modes with caustic radii smaller than that of the operating mode can be suppressed.
To increase the output power while maintaining the ohmic wall loading on the inner conductor at continuous wave compatible levels, we have devised a technique that enhances the efficiency of suppressing fundamental modes by employing a linear tapered corrugation depth on the inner conductor. This approach also increases the range of stable operation of the gyrotron and reduces the susceptibility of the operation to electron beam quality.

References

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