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研究報告 5

Gyrotron cavity analysis for single mode third-harmonic, continuous-wave operation at a sub-terahertz and terahertz frequencies

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Abstract. A cavity design of a 395 GHz gyrotron for DNP experiments operating at the third cyclotron harmonic is presented. The gyrotron is designed to operate at the $TE_{6,4}$-mode, which allows one to produce several hundreds watts output power with the density of ohmic losses acceptable for continuous operation. It is shown that the desired mode is well separated from competing modes. Special attention is paid to the effect of imperfections in resonator fabrication on the gyrotron performance. It is found that to keep the gyrotron performance close to the designed data obtained for an ideal resonator shape the resonator should be fabricated with the tolerances of about one micron, which seems doable in view of the recent experimental data. The same analysis presented for third harmonic 1 THz gyrotron with $TE_{9,7}$ operating mode. The results demonstrate the moderate optimism for high frequency gyrotrons using ordinary magnet systems.

Keywords: gyrotron, sub-THz, harmonics, accuracy of fabrication, resonator Q-factor, starting current, mode competition