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Study of 140GHz and 170GHz gyrotrons for fusion plasma

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Abstract: Aiming at the nuclear fusion experimental reactor, the studies of the 140GHz and 170GHz gyrotrons for the plasma heating have been developed at Beijing Vacuum Electronics Research Institute (BVERI) recently. First version of a 140GHz gyrotron with a single-anode magnetron injection gun (MIG) and the cylindrical resonant cavity operating in the $TE_{22.6}$-mode has been fabricated and tested. In short pulse operation (~70 microseconds), an output power of ~150kW with frequency of 140.36GHz is obtained in the operating voltage of 70kV andthe electron beam current of 20A. The second version of a 140GHz gyrotron has been optimized and fabricated, which adopted a double-anode MIG replacing the single-anode magnetic injection gun in the first version, while the other parameters are the same as the first version. With a pulse width 500μs and a repetition frequency of 5 Hz, an output power of ~430kW with frequency of 140.2GHz is achieved in the operating voltage of 68kV and the electron beam current of 28A, corresponding to the efficiency of 22.6%. The third version of the 140GHz gyrotron with a quasi-optical mode converter and a single depressed collector has been designed and fabricated. At the same time, a 170GHz gyrotron witn 1MW power output has also been studied.

Keywords: Gyrotron, High power, ECRH, EAST, Nuclear Fusion, ITER.

In this paper, the latest progress of the high power gyrotrons for the plasma ECRH will be presented.

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