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Development of Over MW Gyrotrons for Fusion at Frequencies from 14 GHz to Sub-terahertz

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Megawatt (MW) gyrotrons with a wide frequency range from 14 to 300 GHz are being developed for the collaborative Electron Cyclotron Heating (ECH) study of advanced fusion devices and DEMO reactor. (1) In the first experiment of 300 GHz gyrotron, an output power of over 0.5 MW with TE_{32,18} single-mode was achieved with a pulse width of 2 ms. This is the first report of MW level oscillation with the DEMO-relevant ECH gyrotron mode. It was also found that the reflection at the output window affects the oscillation mode determination. (2) A new record of the 28 GHz gyrotron output of 1.38 MW was obtained. The fabrication of a newly designed tube aimed at a dual-frequency output power of 2 MW at 28 GHz (0.4 MW CW) and 1 MW at 35 GHz has begun, with all components ready for assembly. Before installing a double-disk window in the dual-frequency gyrotron, we confirmed the dependence of reflective power on the coolant thickness including the reflective power less than 2 % by the cold test using a Gunn diode power of 1 W and the hot test using the gyrotron output power of 600 kW. (3) Based on the successful results of 77 and 154 GHz LHD tubes, the new design of a 154/116 GHz dual-frequency gyrotron with output of over 1.5 MW has been presented.

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