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Sommario/riassunto	Gyrotrons are high-power mm-wave tubes. Here, the design, construction and experimental investigation of a 20 kW, 28 GHz gyrotron (2nd harmonic) are reported. This tube was designed to evaluate new emitters for future highly efficient and reliable fusion gyrotrons and for material processing applications. Following experimental results have been achieved in CW operation: 22.5 kW output power at 23.4 kV electron beam voltage and 2.23 A beam current with the world record efficiency of 43 %.