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A cold-cathode magnetron gun in plasma mode as driver for a THz generator

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Increasing of electron beam current density is important problem in development of a THz generator. Howeever a conventional thermionic cathode have limited current density. Experiments with magnetron gun with transaction on plasma mode are described. The gun has a metall cathode with a diameter of 6 mm and a length nearly 70 mm. The cathode was coaxially mounted inside a stainless tube with a diameter of 54 mm and a length nearly 500 mm. The tube was used simulteniosly as anode and drift tube. The electodes may were immersed in magnetic field of coils. A direction of the magnetic field was paralel of common axis of the electrodes. The electrodes were coaxially mounted inside a ceramic wacuum chember. The electrodes were connected with a storage capasitor 0.2 mmF. A discharge was controlled by switch on current in the magntic coils. An electron beam up 500 A along the anode tube was observed. A start air pressure was 0.12 Pa. A start voltge was nearly 10 kV. A pulse of the electron beam had exelent repeatability with duration of several mikroseconds. A beam track on a collector was observed as a light spot with a diameter of 10 mm on a collector. So beam current density more then several times higher then from best thermionic cathode. Amplitude of the magnetic field was nearly 50 mT. At so low pressure is applicable vacuum scale law. According the law current density must increase as square of the magnetic field. Conventionaly in a portable THz clynotron a magnetic field are used with strens nearly 20 times higher. That gives us possibility of increasing of current density in several hundreds times with corresponding decreasing of gun dimention and nearly the same total beam current. Nature of superdense emission as self-supported electron secondary emission is discussed.

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