Gas breakdown in a focused beam of powerful sub-THz gyrotron

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The results of experimental and theoretical investigations of gas breakdown thresholds in a focused beam of powerful sub-THz radiation are presented. The gas discharge, maintained by the powerful radiation of terahertz frequency band, is a new specific object of gas discharge physics. Its investigation became possible due to the creation of the powerful sources of THz radiation – gyrotrons [1]. Up to now, several works have already appeared which consider specific features of the development of these discharges in stationary gases and non-uniform gas flow [2-3]. In the paper [4] the results of breakdown in argon by 1kW CW radiation at 0.263 THz were presented. Due to the not so high power the breakdown was observed only for noble gases and in presence of strong preionization. This paper presents the experiments with pulsed gyrotron capable of generation 250 kW power at 0.25 THz frequency. The gyrotron wave beam was focused by means of quasi-optical mirrors into the spot with diameter less than 3 mm that provided intensity into the focal spot up to 3.5 MW/cm^2. Achieved electrical field intensity was enough for gas breakdown into the range of pressure values of 1-1500 Torr for various gases (argon, krypton, nitrogen, air). The boundary values of field intensity for discharge existence were measured. Noble gases data was compared to the analytical model of Raizer and Vyskrebentsev [5] for monatomic gases. Data for air was compared with previous higher-frequency data.

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