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A STUDY ON ATTENUATION CHARACTERISTICS OF EXPLOSIVE EMISSION CATHODE PLASMA BASED ON ULTRA HIGH SPEED CAMERA TECHNOLOGY

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Explode emission cathodes can be used to generate intense-current relativistic electron beams(IREBs) required for high-power microwave(HPM) systems, its characteristics affect the performance of HPM system. This type of cathode forms a plasma on the surface of the cathode during the emission process, and the electron beam is mainly obtained from the plasma. Therefore, the characteristics of the plasma are directly related to the beam characteristics, including the uniformity of plasma generation, the rate of expansion and attenuation. The attenuation characteristics are related to the repetitive performance of the cathode. In this paper, a ultra-high-speed framing camera is used to construct a diagnostic system to take pictures of cathode plasma luminescence. The camera has 12 channels and can perform up to 24 frames. By setting the exposure time and delay timing of different channels, high-speed photography can be performed over a long time to obtain state information of cathode plasma at different time points during the attenuation process after the explosion emission, the result is very intuitive. The intense-current emission experiment was carried out by using a ring-shaped stainless steel cathode. The camera photographed the plasma luminescence on the front the cathode. The image processing and analysis showed that the attenuation time of the explosion emission cathode plasma was about 55μs, and the plasma gradually expanded from the cathode surface to the anode during the attenuation process. The expansion rate is on the order of several cm/μs and is affected by the guiding magnetic field, and the distribution is very uneven. This result has important reference significance for studying the characteristics of explode emission cathode plasma.

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