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The spatial evolution of species during vacuum breakdown

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The initial stage of vacuum breakdown is still lack of direct experimental evidence because it is difficult to observe and measure. The objective of this study is to observe the light emission in the initial stage by optical diagnosis. We adopted a ICCD camera to catch a series of images in a breakdown and two optical filters to distinguish the light from copper atom (Cu I) or singly charged copper ion (Cu II). A tip-to-tip gap was installed in a vacuum chamber; the gap was 2mm; the voltage was provided with a impulse source with a peak value of 30kV; the current was measured by a Pearson sensor with a bandwidth of 200MHz; From the results, a vacuum breakdown was initiated by the electron emission from the cathode surface, leading to a strong copper atom evaporation. Consequently, single charged ions were triggered and expanded from the cathode to the anode. After a short delay, the anode region became much more luminous than the cathode, and the plasma formed in front of anode was spread from the anode to cathode.

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Experiments and Diagnostics

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