Abstract Submitted
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Breakdown process of dual-frequency Capacitively Coupled Plasma: A collective simulation[1] HAO WU, Huazhong Univ, YOUYOU ZHOU, Northwest Normal Univ, JIAMAO GAO, Huazhong Univ, YANLI PENG, East China Univ of Tech, ZHIJIANG WANG, WEI JIANG, Huazhong Univ — Study on breakdown can not only reveal the evolution of electrical feature of plasma, but also verify the theory of gas discharge. Almost all plasma sources have to undergo breakdown process, however, due to the extremely short time interval, it is difficult for experiment to observe this evolution process. One-dimensional direct implicit Particle-In-Cell/Monte-Carlo Collision (PIC/MCC) program is used to study the breakdown process of Capacitively Coupled Plasma (CCP) driven by dual-frequency and coupled with external circuit. The result shows that the breakdown process can be divided into the pre-breakdown and post-breakdown process clearly, and it can be distinguished by the formation of sheath. In the pre-breakdown stage, plasma density grows exponentially, however, because of low initial density, electric field can penetrate the whole discharge area without any blocking, which produce plenty of high-energy electrons, and many of them can bombard the electrode plate to generate secondary electrons. There is a interim phase between the pre-breakdown and post-breakdown, during which both the electron generation rate and heating power of plasma reach the maximum value and the external circuit changes from a linear system to nonlinear system. In post-breakdown stage, the density and temperature of plasma gradually stabilize. CCP device can be approximated as a series of nonlinear capacitance, resistance and "inductance", and capacitance dominates the characteristics of CCP and the changing capacitance is the main cause of harmonics.

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