Abstract Submitted
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Subnanosecond breakdown development in high-voltage pulse discharge. Main mechanisms.[1] IRINA SCHWEIGERT, ANDREY ALEXANDROV, Khristianovich Institute of Theoretical and Applied Mechanics, PAVEL GUGIN, MAXIM LAVRUKHIN, PETR BOKHAN, DMITRY ZAKREVSKY, A V Rzhanov Institute of Semiconductor Physics — A subnanosecond breakdown in high-voltage pulse discharge may be a key tool for superfast commutation of high power devices. The breakdown in mid-high pressure in helium was studied in experiment and in particle-in-cell Monte Carlo collision simulations. The complex kinetic model was developed, based on kinetic simulation of discharge plasma, including dynamics of electrons, ions and fast helium atoms, produced by ions scattering. Attention was paid to electron emission processes from cathode: photoemission by Doppler-shifted resonant photons, produced in excitation processes with fast atoms; electron emission by ions and fast atoms bombardment; and the secondary electron emission (SEE) by hot electrons from bulk plasma. The simulations show that the fast atoms are the main reason of emission growth at the early stage of breakdown, but at the final stage, when the voltage on plasma gap drops, the SEE is responsible for subnanosecond rate of current growth. The influence of SEE yield for three types of cathode material (titanium, SiC, and CuAlMg-alloy) was tested. By changing the pulse voltage amplitude and gas pressure, the area of existence of subnanosecond breakdown is identified.

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